Editorial

IN England, everyone is very pleased with the results obtained from the new television station as Sutton Coldfield, and newspaper reports tell of excellent reception of up to 150 miles. These stated also that here was something which hadn't been equalled anywhere else in the world, and that Australians could hope for good country service by using a transmitter of this type.

Now while this is largely true, it is also true that the results obtained from the new transmitter are entirely what one would expect, because with its aerial system it incorporates features known for many years to be important on television frequencies.

In the first place, the transmitter uses an aerial, almost certainly in the form of all-round-looking array, perched on a mast 750ft high. As the engineers almost certainly picked high ground on which to erect it, the effective height of the aerial would probably be about 1000ft.

Transmissions on these frequencies follow almost optical laws and this great height would therefore greatly improve normal range particularly if the receivers were also in elevated positions.

The power radiated from the station is given as 35 kw. —a truly terrific output at this frequency. The aerial would almost certainly have high gain. Assuming this to be seven times, the radiated power is thus stepped up to about 250 kw.

These are the reasons, without doubt, why the new station is giving such fine results. But there is no reason nor has there ever been, why our Australian stations should not duplicate this performance. To the technical man, there is nothing new about it. Only initial cost is a possible barrier to aerial height and power.

In making the point that the new BBC transmitter contains no magic, but just logical design, we are also making a point for ourselves. Particularly in NSW, we have elevated country in the Blue Mountains which, supporting a 1000ft mast and used with a powerful transmitter, might easily put up distance records for television. A micro-wave link with the studios could eliminate cables for programme relay.

Every credit is due to the English engineers for their latest production. We should reap the benefit by careful observation of their ultimate results, and I know of no reasons why our systems should not improve upon them.

John Moyle

INDEX

	PAGE
Constellation For Radio Tests	3
What We'd Like in 1950	5
History of Electricity (8)	8
Electric Brain Voltages	12
Technical Review	15
Coronagraph Makes Solar Eclipse	19
News and Views of the Month	21
Receiver for 32V Mains	24
For the Junior Experimenter	31
Here's Your Answer Tom	35
Top Cut Filter for Voice Coil	36
Another Error Circuit	43
Facts About Grid Bias	46
The 1950 Radiogram	48
Course in Television (8)	58
Corner Set With A.V.C.	60
The Serviceman Who Tells	63
Trade Reviews and Releases	65
A Reader Built It	70
Long Distance Patrol Bomber	73
Mixing Fuel for Model Aircraft	74
A Simple Electric Motor	78
Short Wave Notes	84
The Ham Bands	87
Off The Record	91
Answers to Correspondents	93

RADIO AND HOBBIES IN AUSTRALIA

A NATIONAL MAGAZINE OF RADIO, HOBBIES AND POPULAR SCIENCE

EDITOR
JOHN MOYLE
S.M.I.R.E. (AUST.)

TECHNICAL EDITOR
NEVILLE WILLIAMS
A.M.I.R.E. (AUST.)

TECHNICAL STAFF
RAYMOND HOWE
MAURICE FINDLAY
DERRICK WILLIAMSON

VOL. 11 No. 10

SUBSCRIPTION RATES

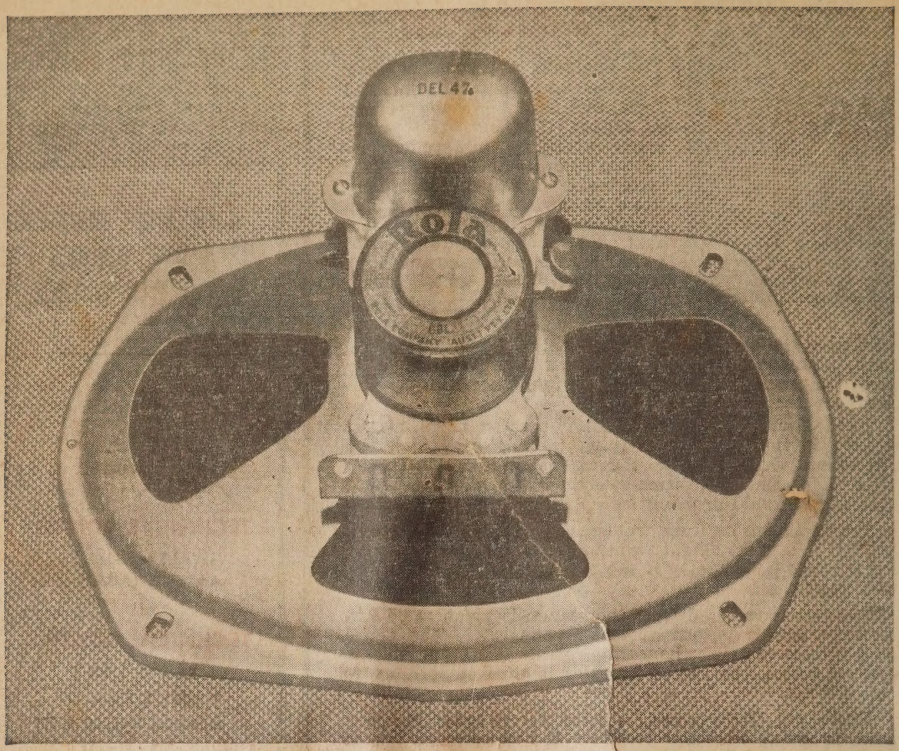
	C'wealth & New Guinea	N.Z.	British Overseas	Foreign
1 year	12/-	13/-	14/6	15/6
6 mths.	6/-	6/6	7/3	7/9

Published on the first Friday of each month by Associated Newspapers Ltd., 60-70 Elizabeth St., Sydney.

Phone ——— BO333

OUR COVER PICTURE

Model aircraft powered by jets are becoming increasingly popular both overseas and at home. Here is a fine shot of an English enthusiast with his jet model. The air pump is used to provide pressure to start the motor.



PERFECT FOR PORTABLES!

This NEW ROLA ELLIPTICAL LOUDSPEAKER

This model is Rola's contribution to the compact design of next year's Portables. The new Elliptical Model 6-9 L gives the equivalent performance of an 8-inch loudspeaker (considered the ideal for high quality portables) yet can be fitted into the space normally taken up by a conventional six-inch model.

ROLA CO. (AUST.) PTY. LTD.

The BOULEVARD, RICHMOND, VICTORIA

and at 116 CLARENCE STREET, SYDNEY.

CONSTELLATION FOR RADIO TESTS

First flight of a weird new Constellation designed to test airborne electronic devices now in development has been announced by the United States Navy. Characterized by two large humps midway along the top and bottom of the normally sleek, streamlined fuselage, the unusual looking airplane also has a slightly elongated nose and a row of antennae running like spikes along the fuselage, fore and aft of the huge radomes. Navy sources stated that it will be used to test advanced electronic systems designed for installation on aircraft. The Constellation is a modified version of the commercial Constellation, familiar to air travellers the world over. More than 200 of the long range, 300 mile-an-hour transports have been delivered or are on order. Normal flight crews are carried by the PO-1W including pilot, co-pilot, flight engineer and radio operator. In addition, facilities are provided within the cabin for technicians and electronic equipment operators. Bunks are installed for relief of crew members on long flights. Engineers reported that despite the bulky external radomes, performance of the Navy's Constellations will not be materially reduced.

The Radio Scene

What We'd Like in 1950

We may find 1950 to be a momentous year in the history of Australian radio. A number of most important matters have been hanging fire now for a long time, and the change in the Federal Government is expected to bring with it a change in the policy concerning some of them. Others are likely to be resolved, not directly associated with broadcasting, but having an important bearing on radio and sound reproduction generally.

IN this article, I want to outline a few things I would like to see happen in this New Year. I think there is an excellent chance that most of them will come to pass, but in any case, a little crystal-gazing is an interesting pastime. It is human to hope for the best, even if there is often a discrepancy between the hope and the fulfilment.

Chief among the matters which I'd like to see resolved is the future in this country of both FM broadcasting and television.

PRIVATE ENTERPRISE

The change in Government seems likely to bring major developments in both these things.

In the first place, the last Government stated in definite terms that neither FM nor television would be made available to private enterprise. Complete control by a Broadcasting Board was instituted, and this board was to introduce the new systems into the framework of the National Broadcasting system. The fact that little was done about either, except a deluge of premature statements which accomplished nothing but damage, is beside the point. The policy was firm, and it was difficult to see any way out of it.

The new Government, on the other hand, has said that it will not necessarily restrict FM and TV to National stations, but is in favor of both being available to private enterprise. These views, if implemented, will completely alter the outlook of broadcasting for the future, for it means their possible use by B class stations in addition to the National service.

CLARIFICATION

The first thing, therefore, that I would like to see is complete clarification of the FM position. This involves a decision as to whether it will be introduced or not, and whether it is preferable to AM on the same bands. This decision might tie up with TV planning, but the answer, yes or no, is the important point.

If it is yes, then the conditions applying to its use should be clearly stated together with a date on which activities may commence. Nothing more or less than this is expected, and certainly no other course of action will be of any value to the radio industry, which has been left far too long in a state of suspended animation.

If the use of FM is approved, then I would like to see it's possibilities fully exploited in accordance with proper planning.

This would probably involve a long transition period during which stations suitably situated within approved operating areas could radiate on their present frequencies in addition to their new FM frequencies. The logical outcome would probably be a target date some time in the future for final abandonment of the broadcast band transmissions.

Those areas in which present stations must be preserved because FM cannot supply an equivalent service should be named, together with the probable dates upon which any alternative system of FM relays, &c., might be expected to supplant them if at all.

Only by doing the whole job on such a planned basis, stated as definitely as practicable, and suitably amended as the plan develops, could FM serve a useful purpose. And until such a basis can be announced with confidence, it would be far better to forget it, and leave matters as they now stand.

FM AND AM

I have used the term FM to imply its use on the higher frequency bands. The above comments however would apply equally whether the system of modulation is to be FM or AM.

I would certainly like to see an exhaustive side-by-side field test made in 1950, and soon, to establish whether in truth, the FM system is better than AM, bearing in mind not only transmission problems, but receiver costs, and the standards of optimum performance needed for high quality reception and transmission. These standards must be high, but they should be practical standards, and not figures determined by a laboratory ideal.

To date, no such comparison has even been made public, and I feel it not too much to ask that it should be carried out.

It might be that the FM plan might alter considerably our present balance of listening. There is, unhappily, far too much room for improvement in our present highly competitive programme presentations. There could be a much better distribution and balance of material.

It is hard, for instance, to see the justification from the listener's angle for every local station to broadcast the same horse race at the same time. Plenty of listeners aren't at all interested in racing. It should be quite possible to recast the whole programme position without prejudice to the principle of private enterprise in broadcasting.

A more positive interest in broadcasting generally must result from such an approach. Commonsense and experience will, of course, be needed, but the results should give to us the best broadcast coverage in the world.

Incidentally, this new programme approach need not necessarily depend on the introduction of FM. It can almost rank as the second thing I'd like to see happen in 1950.

Next on the list, of course, is television. Here I think a re-examination could well be made of the whole project to determine whether we should or should not postpone its introduction.

ADVENT OF COLOR

Things are moving fast in the television world. The advent of color, for instance, with the possibility that it might be just as practicable in a couple of years as black and white, is a very good reason for a careful stocktaking.

We must remember that such a vast enterprise, once launched, will be enormously difficult and costly to change, as we have seen demonstrated so clearly overseas.

England seems wedded now to the 405 line system which is actually a prewar standard. America is hesitating in her great television stride, faced with just this problem of future standards. Here in Australia we cannot afford to make a mistake. This is the critical moment for the exercise of great technical vision.

On the other hand, if the decision should be that we are to have television on substantially the same lines as have been indicated to date, then I can see no reason to delay the announcement of a full plan as soon as possible. If television systems are to go out of date, and it's hard to believe otherwise, we must get as much from our first effort as we possibly can.

With television, the principle of private enterprise might prove more

difficult in practice than with broadcasting. It is possible to make quite a case for restrictions of television services as against a complete free-for-all basis of operation.

It would be so tragically easy to dissipate valuable effort through too many channels which would be much more effective if concentrated through one or two outlets. Our resources are pitifully small to support such a vast entertainment enterprise. The future may show that we cannot do so without considerable outside help.

In this connection, however, I am much more concerned with the announcement and implementation of a firm policy than I am with the details of the policy itself. As with FM, the urgent need is for complete clarification of what is to be done, so that those who have to do it know just where they stand, and just what stability they can expect in the part they have to play.

In other words, the radio industry is completely fed up with unwise official statements badly timed. Only clear and definite Government action can really break the stalemate we have had far too long.

RECORDED MUSIC

Leaving now these major problems, I'd like to see big improvements in the field of recorded music. In this, I know my ideas will be thoroughly endorsed by those who produce the recordings and whose biggest problem is how to make these improvements practicable.

These improvements will be of clue not only to gramaphone enpoiasts, but also to broadcasting cons which are major record indu biggest disadvantage in my rubb with present discs is their high ing scratch level. With the introduction of better reproducing equipment, this is not only a nuisance now, and the limiting factor in record reproduction, but I believe it must eventually limit sales particularly of the better class music, which is growing in popularity every month.

The growing use of vinilyte and simliar record materials leads one to believe that quiet records can be made, although initially their cost may be higher than older types. I am quite satisfied that the material and psychological advantages they bring will make their introduction just as important as that of electrical recordings years ago.

I just cannot see how the wider range now possible on disc records can have anything like its full value until quiet backgrounds allow us to really hear it.

LONG PLAYERS

The long-playing record comes into the picture as well, and is another thing I'd like to see here in 1950. Together with reduced scratch level, it will give an entirely new conception to disc records and bring with it substantial new enjoyment, flexibility, and popularity.

It may well be that if my hopes are fulfilled, we may at last have records which are so good that it will be hardly worth while making them much better. We must not be blind to the advances made lately with tape recordings, which now far outstrip disc records in many important particulars.

Only the quiet surface with the added long playing feature where desired can decide the issue of the disc versus tape or other media. And upon that issue, the ultimate course of recorded music seems at the moment to depend.

PSYCHOLOGICAL ADVANTAGE

I would stress once more the great psychological benefits of the long playing disc. We have so long accepted the tension set up by anticipating the end of each disc that we have become conditioned to it. Only actual experience of 15 minutes or so of unbroken listening can make one aware of how drastically the four minute breaks have interfered with our enjoyment.

And surely it is only logical to ask our record manufacturers to help us obtain a full symphony movement without disc changing. I know they are working on the problem, but I do hope they will have something to give us in 1950.

We need better gramophone motors, too, which are smooth-running, and without rumble. With wider range equipment and lower output pickups, quiet, reliable motors are essential, hard to get, and expensive.

It may be that all these improvements in sound reproduction will be solved in one big forward step. If this step also includes a few locally made wide range loud speakers, I think my want in this regard for the new year will just about be satisfied.

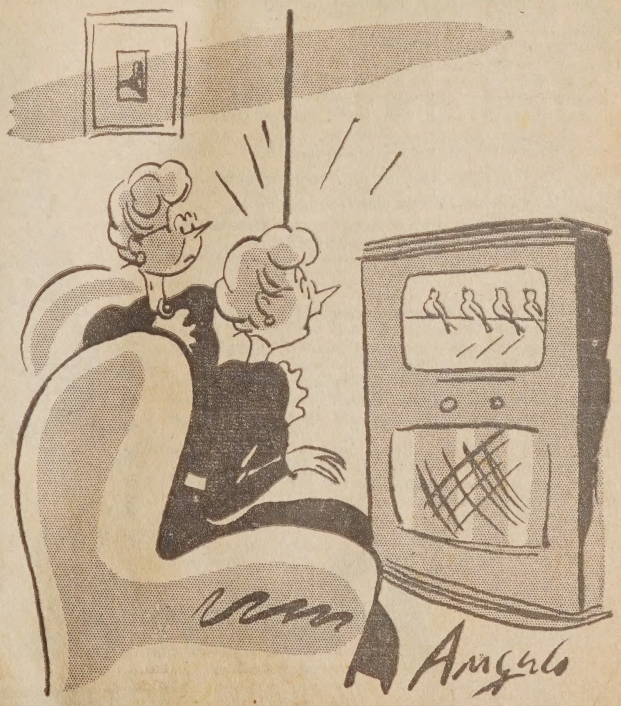
Lastly, of the many additional things I'd like to see, which are too numerous to mention, is a big growth in the activities of amateur transmitters, particularly on the higher frequencies—a rebirth of the pioneer spirit which built up the art in the past.

The amateur transmitters are a most valuable section of the radio community. In their ranks, young and old receive essential radio training in a wide variety of subjects, and they can never be too many, or too enthusiastic.

I would like to see, however, a little more awareness on the part of the average amateur concerning his responsibilities to himself and the community. During 1949, we had several examples of wonderful amateur work in national emergencies. But on the debit side, one finds little reduction in the instances of poor operating, which don't help the cause. The sense of amateur unity of purpose has advanced tremendously in the last few years, but it can never be too strong if the amateur movement is to fill its full purpose and destiny.

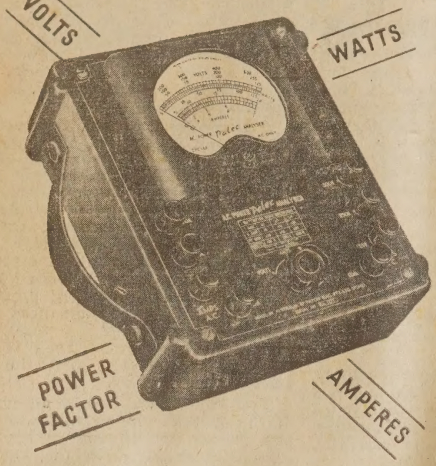
Yes, 1950 is likely to be an eventful year. Both the radio trade and the private citizen will watch the march of events with the keenest anticipation. There are great possibilities ahead, and it requires only the application of energy, co-operation, and decision to bring stability and progress to a great industry.

—The Editor.



"They're sitting on our aerial again!"

2 NEW PALEC STARS



PALEC MODEL PA POWER ANALYSER

1

The Palec A.C. Power Analyser, Model PA, Australia's first dynamometer multi-meter, for electrical service, maintenance and testing.

RANGES:

VOLTS A.C.-D.C.	AMPERES A.C.	WATTS A.C.
0 — 125	0 — 1	0 — 10,000
0 — 250	0 — 5	9 ranges of watts
0 — 500	0 — 20	3 for each voltage range

POWER FACTOR: $\frac{\text{WATTS}}{\text{VOLT. AMPERES}}$: Rotary switch selection without disconnecting circuit.

POWER CONSUMPTION: Negligible.

ACCURACY: Effects of wave form, power factor, voltage, current and frequency variations are negligible.

The Palec A.C. Power Analyser incorporates a true dynamometer movement of the nickel-iron cored type. There are no rectifiers or non-linear resistances included, nor is it necessary to compensate for line voltage in wattmeter readings.

APPLICATIONS: Industrial maintenance, production testing, laboratory work. Particularly suitable for testing and servicing refrigerators and other motorised appliances. D.C. as well as A.C. voltage may be measured.

EXTRAS: Leatherette-covered carrying case, external resistance box for 3-phase testing and current and potential transformers for extending ranges supplied at extra charge.

DIMENSIONS: The Palec Power Analyser is housed in an exclusive semi-hard rubber case, size 8 inches by 9¼ inches by 4½ inches overall. Weight, 8 lbs.

Price: £23/15/- plus tax.

PALEC M.30 MULTIMETER

2

Model M.30—new 30-range multi-meter (superseding the famous model MCA)—is indispensable for modern radio and electrical technique.

Ranges—

D.C. Volts 0—0.1—3—10—30—100—300—1,000.

A.C. Volts 0—3—10—30—100—300—1,000.

D.C. Milliamps 0—0.3—1—3—10—30—100—300—1,000.

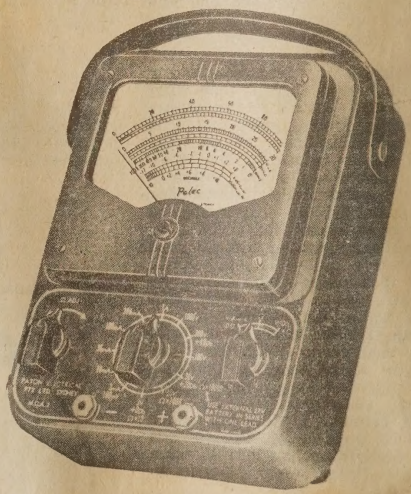
Ohms 0—10,000 and 0—1 megohm with internal Batt.
0—10 megohms with external Batt.

Decibels (a) Zero reference level = 6 milliwatts in 600 ohms: —17 to +3: +3 to +23: +23 to +43.
(b) Zero reference level = 1 milliwatt in 600 ohms: —10 to +10: +10 to +30: +30 to +50.

Other features: Meter scale, 4"; all measurements from two terminals only; bakelite housing; test leads supplied. *Accuracy, reliability, low cost.*

£11/17/6, plus tax.

M.30 MULTIMETER



Palec Paton Electrical PTY. LTD.

Manufacturers of all Types of Radio & Electrical Test Equipment & Meters.

90-94 VICTORIA STREET, ASHFIELD, SYDNEY
Tels.: UA 5266 (5 lines). Telegrams: "Palec."

MICROWAVES USED TO MEASURE MOLECULES

Tiny "microwaves," similar to those used by radar sets aboard high-altitude bombers during World War II to aim bombs through thick clouds, are now being employed in the General Electric Research Laboratory to measure molecules.

WITH such waves a fraction of an inch long, aimed through gases, scientists are finding the dimensions of certain molecules and how fast they spin. One, for example, has the shape of a triangular pyramid of four atoms, with a fifth atom supported above like a statue on a pedestal. Dr. A. Harry Sharbaugh, who heads these researches in the laboratory chemistry division, finds that the molecule may spin 26,695,200,000 times per second.

FANTASTIC SPEED

This particular molecule is known as chlorosilane, and it is of fundamental importance in the chemistry of the silicones. These are compounds containing the element silicon, which are rapidly finding great industrial importance as oils, greases, rubbers, metal finishes, waterproofing materials, &c.

The radio microwaves vibrate on the average about 24 million times per second. Like F-M radio broadcasts, however, this frequency swings up and down, above and below the average value, while the waves are sent through a 16ft rectangular pipe containing the gas under study. Most of the time they pass through freely, but when they happen to be at one of the characteristic rates of the molecules, they are absorbed, and their energy sets the molecules into increased rotation.

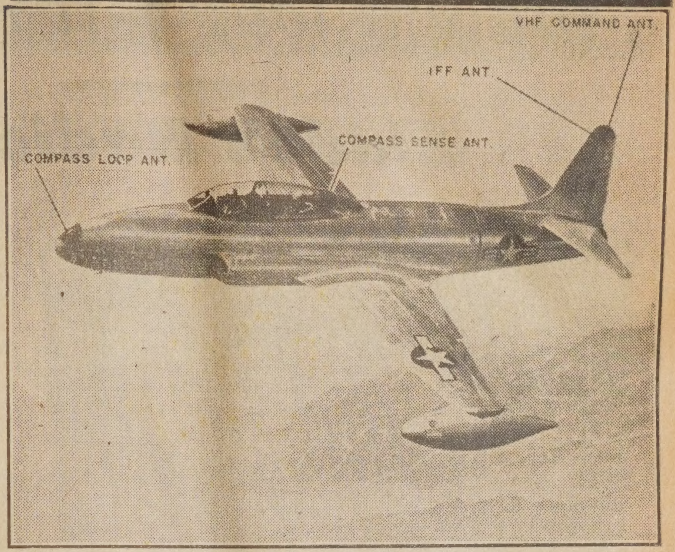
CRO INDICATOR

Working with the method, the scientists watch a horizontal green line on the face of a tube similar to that used to receive television pictures. A dip in the line shows when absorption occurs, and the frequency is measured by comparison with a standard.

While this technique originated in 1933 with two University of Michigan scientists, it has only become a practicable scientific tool since the war, because of the great advances made in electronic devices for producing and controlling the tiny radio waves.

The new technique represents an important extension of the science of spectroscopy, used to study laboratory samples or the properties of distant stars.

IN-BUILT AERIALS FOR AIRCRAFT



Flush antennae rank important among this year's outstanding aeronautical developments. Ten major aeronautical advances during 1949 were listed recently by technicians at the Wright-Patterson Air Force base, research centre for the USAF and important source of data for the US aviation industry.

THE advent of high-speeds and the necessity for removing all protuberances from aircraft fuselages has resulted in the development of new flush-mounted radio antennae for all types of airplanes.

It has been estimated that at top fighter speeds, it took 200 horsepower to overcome the drag of old-style antennae alone.

On the F-80, standard jet fighter for the USAF, five separate installations of flush antennae have been completed, including compass loop antennae in the nose, compass sense antennae in the cockpit canopy, and two types in the tail: VHF command radio, and identification friend or foe (IFF) radio.

Flush antennae not only reduce drag, but minimise icing dangers, add protection from precipitation static, and remove the pilot's fear of losing external instruments.

Sections of the aircraft which carry the inbuilt aerials are made of non-metallic material. The idea is practicable mainly because the high frequencies used for many types of communication and navigational aids require small aerials as against the longer wires employed for lower frequency equipment.

Sun Future Source of Energy

The sun, not the moon, may be the principal source of power for the world in future days, it was predicted by Frank R. Benedict of Westinghouse Electric Corporation, Pittsburgh.

SOLAR energy, he said, holds promise of supplementing our dwindling supply of coal, oil and natural gas, and may ultimately meet all the needs for power. It is common belief that in atomic disintegration we have an untapped source of practically inexhaustible energy, he continued, but this is not true. Limited amounts of the two fissionable elements, uranium and thorium, will control the broad scale applications of atomic power.

While "unrenewable" sources of energy such as coal, gas and oil now are our principal power sources, they can continue to provide all energy requirements for only another 100 to 300 years. Beyond that, the "continuous" sources, such as the sun's radiation, vegetation growth and water-falls, off re chief hope.

To harness this energy, scientists still must devise means of capturing energy now lost when the sun's rays are reflected off the earth's surface. They also have to find out how to increase the amount of solar energy converted by the earth into combustible materials such as wood, and the amount converted in the waters of the earth, causing evaporation.

The water of our earth absorbs much of the sun's energy falling upon it. The amount of energy theoretically recoverable is about 54 times our total requirements.

Filling a long felt want—

Slade's Radio Pty. Ltd.

MODEL 508

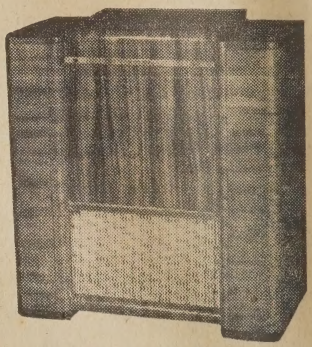
makes available to Radio Dealers and Home Constructors a full range of Console Radiograms and Combinette Cabinets.

Made from best quality Maple and Italian Walnut-veneers, finished with a brilliant piano finish.

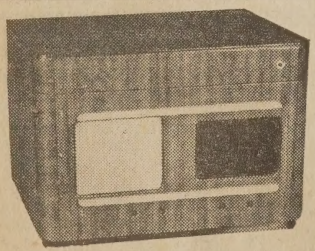
Model 508 is suitable for all types of Record Changers.

Model 509 is suitable for Single Motors. Dial fits on front of Cabinet Lid being lifted only for record playing.

Model 510 is a Combinette type Cabinet large enough to take a 5 Valve D/W Set with a Single Motor.



MODEL 509



MODEL 510

Expert packing for all out of Town Deliveries.

Where desired, bare chassis or chassis and dial can be supplied to suit each type of cabinet.

WRITE OR CALL AT OUR FACTORY FOR FURTHER PARTICULARS.

See them on display at Radio House, 296 Pitt St., Sydney, or at

Slade's Radio Pty. Ltd.

LANG STREET, CROYDON, NSW
Tel. UJ5381 — UJ5382

ESTABLISHED 30 YEARS.

THE HISTORY OF ELECTRICITY—8

By one fortunate discovery—which was as unexpected as it was technically spectacular—Hans Christian Oersted, a Danish Professor of Physics in the University of Copenhagen, raised himself to a pinnacle of celebrity in the electrical world of the early 19th century.

IT was the discovery of the magnetic effects of the electric current which suddenly made Oersted famous, and which resulted in nearly all the scientific societies and associations in Europe flinging their honors at him in what must have been a somewhat embarrassing profusion.

Yet, for this single discovery, Oersted is undoubtedly entitled to the renown of being the "Father of Electro-magnetism," although, let it be added, he himself did comparatively little afterwards to apply the great fundamental principle which he had unwittingly stumbled upon.

As far back as the days of ancient Greece, philosophers postulated that there might be some connection between the attractive power of rubbed amber and other "electrics" and that of the natural lodestone, the one, as we now know, being an electrical phenomenon, the other being a magnetic attraction.

"ELECTRICS" AND MAGNETISM

Right through the ages, experimenters and other people who speculated over these matters had a sort of intuitive feeling that these two attractive forces must be related to each other in some way, but, try as they might, they were never able to hit upon this supposed hidden connection between the two forces.

When Alessandro Volta came out with his first electric batteries, so strong was the general conviction among experimenters that these devices would give the clue to the mysterious relationship between electricity and magnetism that many of them actually hung up one or more of these batteries by means of insulated strings and tapes in the expectation that, under favorable circumstances, the voltaic cell would behave like a magnet and align itself along a line running north-south. This was an experiment which failed.

CURRENT PIONEER

Oersted was one of the first investigators to use the voltaic cell and Volta's Pile for the production of electricity in a state of flow. That is to say, he was a pioneer in the utilisation of the electric current as distinct from electricity in an accumulated or static condition. As far back as 1812 he published a pamphlet which endeavored to prove or, rather, to deduce a relationship between electricity and magnetism. But the comparatively feeble currents which were then available to him precluded an exact experimental verification of the attractions and repulsions of electrical polarities, so that his explanations of electro-magnetical relationships had necessarily to remain mere surmises, which, at that time, is just exactly what they were.

Then comes the chance demonstration of the existence of electro-magnetism which was made by Oersted in 1819 and of the exact details of which several accounts, not all in agreement among themselves, have come down to us.

HANS CHRISTIAN OERSTED.

The life and career of Hans Christian Oersted proceeded with great regularity and precision. Indeed, it might almost be said to have been dull and monotonous in its successes. If Oersted ever stopped to count up his many academic and social honors he must have spent a considerable time over the job, for, at his zenith, he gained a lion's share of appreciation and acclamation in European scientific circles.

Yet Oersted himself was of very humble origin. His father was a poor village apothecary in the little Danish town of Rudkjobing, situated on the island of Langeland. Here he was born on August 14, 1777. His father, although he seems to have appreciated the value of true education and vocational training, had not the means to send his children to any school, but he contrived to keep his two elder boys out of mischief by sending them for an hour or two every day to an old German wigmaker and his Danish wife, who lived in retirement nearby.

The two Oersted boys were Hans Christian and Anders Sandoe, the latter being the younger of the two by one year. Anders Sandoe, incidentally, became a leading lawyer in Denmark, and after the death of his brother he rose to the dignity of being the Danish Prime Minister.

Christian Oldenburg, the retired wigmaker, taught the Oersted lads German, and his wife taught them to read in their own native language. The Oersted parents, also, contributed to the brothers' education, and, between these painstaking tutors, they picked up a smattering of languages, mathematics, Latin, History and English, in addition to acquiring a foundational training in the "three r's."

TWO BROTHERS

At this stage, the brothers divided in their individual tastes. Hans Christian followed his taste for poetry, romance and history, while Anders developed a peculiar attraction to law and philosophy. Nevertheless, so close was the connection between the two brothers that each endeavored to impart to the other the substance of any new learning which he had received.

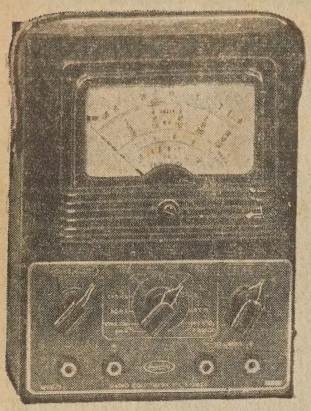
For some years the two boys went on in this peculiar educational partnership until, in the autumn of 1793, they became students in the University of Copenhagen, Anders plunging into law and philosophy, in which domain he was afterwards to become eminently successful, while Hans Christian betook himself to the study of medicine, astronomy and physics.

During their half-dozen years of student life at Copenhagen, the two Oersted brothers carried out methodically the principles of their strange partnership, Anders indoctrinating Hans Christian with the various principles of law and philosophy, and Hans Christian, in his turn, passing on the elements of anatomy, physics and astronomy, to say nothing of "minor" sciences such as chemistry and electricity, to his legal-minded brother.

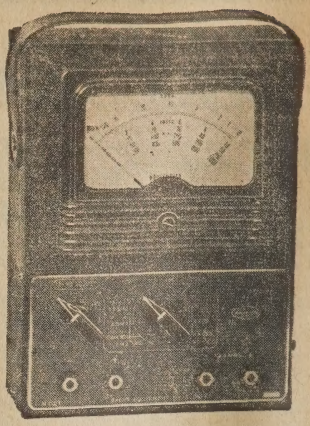
At the age of 21, Hans Christian, the future physicist, gained a doctorate in Medicine and Philosophy.

CHANCE DISCOVERY OF ELECTRO-MAGNET

New...Two more



UNIVERSITY Multimeters!



HOUSED IN ATTRACTIVE NEW CASES . . . AND MANY NEW FEATURES!

Model MVA/2-AC/DC

Famed throughout the radio electrical industry in Australia, New Zealand and the near East, Model MVA Multimeter has been supplied in thousands. It has been used extensively in Trade circles, Military organisations and Government Departments. Now it comes to you in a new improved version with a "new look" appearance, and additional features. This new model, MVA/2, really has something. It is a reliable first class instrument—designed for either use on the bench, or as a portable instrument in the field. As with all "University" test equipment, the heart of the instrument is the latest "University" four inch square meter with clear open scale. The following ranges are provided:

D.C. Volts, A.C. Volts, Output Volts .. .. — 0/10, 0/50, 0/250, 0/1000. The sensitivity of the voltage ranges is 1000 ohms per volt.

D.C. CURRENT .. .. — 0/1, 0/10, 0/50, 0/250 mA and 0/10 Amps. Ranges are automatically compensated to prevent error due to changes in atmospheric temperature.

Resistance .. .. — 0/1000, 0/10,000, 0/100,000 ohms and 0/1 megohm. Resistance values as low as .25 ohm can be measured on the low scale. Special circuit retains accuracy, despite voltage changes as battery ages.

Output Ranges .. .. — Minus 10 to plus 5db, plus 4 to plus 19db, plus 18 to plus 33db and plus 30 to plus 45db.

Controls and readings are on heavy brass etched panel. Instrument is built into sturdy brocade finished metal case with plastic strap carrying handle. Resistance ranges operate from internal batteries. Price: £11, plus 10 per cent sales tax. Size: 8" x 6" x 3" excluding handle. Complete with test leads and instructions. Range can be extended up to 50 Amperes with "University" plug-in shunts. Leatherette covered carrying case is available separately if so desired.

Model MVD/DC

Pictured above is a new D.C. Multimeter of high quality specially designed for radio service and electrical work. It is a reliable instrument which carries the guarantee of satisfaction in the famous "University" Trade Mark. The following ranges are provided:

D.C. Volts .. .. — 0/10, 0/50, 0/250, 0/1000. The sensitivity of the voltage ranges is 1000 ohms per volt.

D.C. Current .. .. — 0/1, 0/10, 0/50, 0/250 mA and 0/10 Amps. Compensated ranges to minimise error due to atmospheric changes.

Resistance .. .. — 0/1000, 0/10,000, 0/100,000 ohms and 0/1 Megohm. Values as low as .25 ohm can be measured. A special Ohms circuit retains the original accuracy, although the battery may vary due to age.

This special 10 Amperes range is of particular value in the servicing of battery and vibrator receivers. This range can be extended to 25 or 50 amperes with "University" plug-in shunts, which can be purchased at any time. Shunts are also available for lower ranges, such as 2.5 or 5 amperes. No further calibration is necessary when using these popular current shunts. The various ranges of volts, ohms, milliamperes are selected by means of a foolproof switching system, which prevents changes in accuracy due to switch wear and contact resistance of the switches. The meter is the well-known "University" Model R4 rectangular type, fitted with an easy-to-read scale. Controls and ranges are clearly indicated on an etched brass panel. MVD is built into a sturdy brocade finished metal box with plastic strap carrying handle. It is complete with test leads and instruction booklet and has built-in batteries. Price: £8/17/6, plus sales tax 10 per cent. Leatherette carrying case extra if required. Size: As M.V.A./2.

THEY'RE **University** INSTRUMENTS

Manufactured by Radio Equipment Pty. Ltd., 5 North York Street, Sydney. Phones: B3678, B1960.

DISTRIBUTORS IN ALL STATES.

The year previously, he had gained a gold medal for poetry, and, additionally, he seems to have acquired some smaller prize in chemistry about the same period.

The first job which Hans Christian pursued after leaving the University of Copenhagen was that of manager of an apothecary's shop in that city. But the job seems to have been a poorly paid one, for he had had at once to supplement his income by lecturing to medical students on the elements of chemistry.

EUROPEAN TRAVEL

In the following year he left Copenhagen and set off on a tour of Germany, Holland, Belgium and France. During this journey, which extended over a couple of years, he met with various adventures, introduced himself to most of the leading lights in European science, translated a book or two for some of them, did a little popular lecturing and eventually returned to Copenhagen.

Oersted's next step was to apply for the vacant professorship of Physics in Copenhagen's University. But in this application he was unsuccessful, being adjudged too young. Nevertheless, he received a sort of Government retaining fee for the express purpose of devoting himself to scientific experiment and giving lectures in science in the university.

It was during this formative period that Oersted gained first-hand familiarity with the electrical investigational work (such as it was) of that period. In 1809 he wrote a book entitled, "Manual of Mechanical Physics," which was a sort of handbook of the laboratory arts. The volume was successful, and it brought him considerable fame in Denmark.

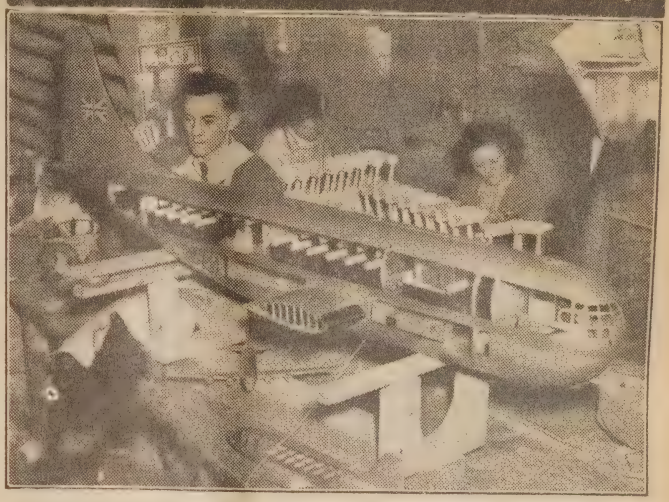
Then during the years 1812 and 1813 he travelled again in Germany, wrote another successful book on "View of the Chemical Laws of Nature," and generally publicised himself throughout the German scientific world.

In 1814 Oersted found time to get married. He had a family of several sons and daughters, but they never attained anything more than a comfortable mediocrity, and, with the exception of one daughter, Mathilde, who subsequently published an account of her father's work, none of them evinced any interest in their parent's career.

During the summer of 1818, by command of the King of Denmark, Oersted undertook a geological exploration of the Danish island of Bornholm. Therein he discovered vast seams of coal and iron ore which were afterwards commercially exploited.

Such were the circumstances and interests of Hans Christian Oersted about the time of his noted discovery of electro-magnetism. Oersted had now, like his brother Anders, become one of the leading men of Denmark. He was nothing if not an academic handyman. Doctor, philosopher, physicist, electrician, chemist, poet, traveller, mineralogist, literary man—all these, and many other roles, the ubiquitous Oersted was apparently able to fulfil at will.

STRATO CRUISERS IN MINIATURE



STRATOCRUISER "PRODUCTION LINE"—At the London factory of James Walker Ltd., manufacturers of "Westaway" models, Boeing Stratocruisers are steadily rolling off the production line for B.O.A.C. They are models for display in the Corporation's and travel agents' booking offices. One special model, seven feet in length, has been produced for the window of B.O.A.C.'s booking office in London. The fuselage is made of moulded perspex to permit inspection of the interior layout. The interior furnishing and layout of the model is authentic down to the smallest detail and even includes packing cases and containers in the freight compartment. With the increasing popularity of air travel, the production of authentic scale models has become a thriving ancillary industry which demands considerable knowledge of the construction and operation of the original types of aircraft. The fuselage of the Stratocruiser, illustrated in the attached photograph, was made in two halves on wooden formers and the interior furnishings were constructed and assembled separately. The two segments of the fuselage were cemented together and the "crew's quarters," comprising the nose, were sawn off. The assembled twin decks were then carefully slid into position inside the transparent fuselage and the nose portion cemented into place. Other models now "on the production line" include the Argonaut, which has recently been introduced on several B.O.A.C. routes to the East and Far East, and the Handley Page Hermes, 25 of which are on order for the Corporation.

THE FAMOUS DISCOVERY

The discovery which made him famous came about the autumn of 1819. As we have previously mentioned, reports differ on the subject of the actual circumstances of the discovery, but the narrative which has received the most credence has it that Oersted was lecturing to a class of students and demonstrating electrical experiments to them when he chanced to observe that every time he made a connection to a Volta's Pile for the purpose of showing the heating effects of the electric current, a compass needle in the vicinity of the Pile was seized with a violent oscillation.

The effect was repeated three or four times during the course of the lecture, but Oersted said nothing to his students about it. However, immediately after they had departed from the lecture-room, Oersted, explaining the circumstances to his assistant, hastened to repeat the phenomenon of the oscillating compass needle and to ascertain its causation. Within less than half an hour he found that the compass needle was deflected in consequence of a wire which lay, by chance, very near to the compass needle. When current passed through this wire, the needle became automatically deflected.

Whether Oersted realised the full significance of his discovery at that moment we do not know. But he did so afterwards as a result of other experiments which he subsequently made, and he announced his discovery of electro-magnetism to the world in a Latin pamphlet which, on July 21, 1820, he posted to all the learned societies in Europe. In this pamphlet he stated that a current flowing through a wire produces a magnetic field around the wire and that if a magnetic needle is brought into the influence of this field it will set itself at a tangent to the circular field of influence, that is at right angles to the path of the current. One of the poles of the needle will tend to revolve round the conductor in one direction, and if the direction of the current is changed, the needle will tend to revolve in the reverse direction.

ELECTRICITY PRODUCES MAGNETISM

In short, a current flowing through a wire creates around the wire a field of magnetic influence. Electricity has produced magnetism. The long-hidden and extensively sought connection between the two has at long last been disclosed.

(Continued on Page 86)

TINY ELECTRIC BRAIN VOLTAGES

The science of medicine uses instruments for the detection and analysis of irregularities in the human body. These instruments are as intricate and varied as those used by any other branch of science.

ONE of the most interesting is that used to analyse the electrical currents produced in the human brain.

To many it will come as a surprise to hear that the brain generates electricity, but this need not cause one to run away with the idea that here is a source of supply with which to light one's house or run the radio.

Neither is the amount of electricity produced a reliable indicator of the brain power of an individual.

SMALL VOLTAGES

The amount of electricity produced is so small that it would require the heads of about two hundred thousand people coupled together to produce one volt. About six million people would be required to light the dial lamp of a radio receiver. Thus the matter is an uneconomical one from the point of view of conservation of power.

That electrical currents are produced in the brain has been known for about 60 years. In 1891 two men, Gotch and Horsley, demonstrated by means of a special galvanometer the currents produced in exposed brains of animals.

Then, in 1929, a chappie named Berger proved that similar changes of electrical potential in the brain of humans could be demonstrated with contacts applied to the scalp.

This was confirmed by two more scientists in 1934 (Adrian and Matthews), but these two went further and demonstrated that the impulses originated in what is called the parieto-occipital region of the brain. This is located at the top of the head and towards the back on both sides.

Today great advances have been made in analysing the electrical impulses of the brain.

The instrument used is called an electro-encephalograph. It consists merely of up to four electrodes for contact to the scalp, an amplifier for stepping-up the potential received from the electrodes and an oscilloscope for making the received impulses visible, or an alternative arrangement of an ink-writing apparatus for writing the waves in ink or a photographic process of recording the waves.

The ink-writing oscillograph is very popular because of its economy and simplicity.

USE OF INSTRUMENT

In use the instrument is easily set up. The hair is cut short or, in the case of those who do not wish to have their crowning glory mutilated, the hair is merely pushed aside. The scalp is cleaned with that well-known beverage alcohol and then moistened. The electrodes are applied and things are all set to go.

Dr. Lee Navis of the University of Southern California placing the electrodes on the ear and back of the head of his assistant to record electrical brain impulses. The impulses, magnified 300,000 times, are shown on the strip at the bottom of the picture. The even and regular patterns at the extreme left show a blank, relaxed mind with the intrusion of sudden thought.

This description sounds very much like the preparations for an electrocution in the "chair," but it is nothing like that. Nothing is felt by the victim except possibly an unfavorable reaction when the bill comes in.

The electrodes are of various kinds, but the two most popular are a pad moistened with salt solution and a metal gadget. The saline pad is useful when it is necessary to move the electrode around different portions of the scalp. The metal electrode is mainly used when prolonged investigation is required. In such cases it is fixed to the scalp with collodion.

When a single electrode is used a connection is made to the subject's ear and "earthed." The single electrode is connected to the amplifier.

SINGLE POINT

The single set-up is useful for recording the potential changes at a single point in the brain. It gives an accurate record of the wave form and is, therefore, useful for the investigation of fits and various types of epilepsy.

Another arrangement makes use of what are known as "paired elec-

GIVE KEY TO THOUGHT PROCESSES

trodes." In this system four electrodes are placed at different points of the scalp from front to back on one side. These are fed into three amplifiers and the results help to localise the focus or seat of activity.

The potentials generated by the brain are, as has been pointed out, extremely small. They range from 5 to 100-millionths of a volt.

In health, the potential is from 10 to 100-millionths of a volt and the waves have a frequency of approximately 10 cycles per second.

FREQUENCY

At childhood, the frequency is about six cycles per second. This increases until about the age of 50 when the frequency diminishes. Whether this indicates the approach of second childhood I do not know.

A strange thing is that the waves are not present when the eyes are open, but occur when the eyes are shut. They also appear and disappear at irregular intervals.

With the eyes shut, some mental effort or a sudden noise will usually cause the waves to disappear, or, at least, diminish in strength, and it sometimes happens that if the subject can bring about sufficient mental relaxation with the eyes open, the waves will appear.

The type of wave described above is called the "Alpha" wave. There are other forms of waves which appear during sleep.

The Alpha waves are always present in blind people, although certain stimuli or noise may cause their temporary disappearance.

This presence of the Alpha wave has been used to distinguish true blindness from malingering or hysterical blindness.

When the subject is made to open his eyes and attempt to look at an object, the waves will be present if the subject is truly blind, but disappear if he is malingering or hysterical.

It is thus thought that the Alpha waves depend for their presence on that part of the brain which controls the visual function.

BETA WAVES

There is a wave called the "Beta" wave, smaller than the Alpha wave, and with a frequency of from 18 to 25 cycles per second.

If this wave could be amplified and fed into a loudspeaker, it would produce a very low note, similar to the pedal note of an organ. Not much is known about these waves, but it is somewhat significant that they have been recorded most from people with wrinkled foreheads and raised eyebrows.

The behavior of the cerebral waves during sleep is peculiar. During the early stage when the individual is drowsy and the eyes are closed, the Alpha waves are present. Immediately sleep comes, these waves disappear and other groups of waves appear with a frequency of about 15 cycles per second. Later, larger and longer waves appear. These are called "Delta" waves.

When dreaming, Alpha waves are most likely to reappear, but in hypnosis the alpha activity is slower.

The electro-encephalograph is mainly used in the diagnosis of cerebral tumors and epilepsy, and the study of increased pressure on the brain.

With increased pressure on the brain, the slow "Delta" waves mentioned above appear all over the

by Calvin Walters

head. These have a frequency of about three cycles per second and a voltage of about 100 one-millionth of a volt.

Increased pressure can be caused by concussion of the brain, meningitis and tumors.

If the increased pressure is caused by a tumor, the location of it may be determined by artificial reduction of the pressure. The waves are then confined to the area indicating the site of the tumor.

When the electrode is moved about the skull, the "Delta" waves are only present when the electrode is directly over the area of the tumor. It has been found that the waves are not produced in the tumor itself, but in the brain tissue surrounding it.

SPECIAL CASES

In people subject to epileptic fits there may be changes in the wave form of the brain even when the subject is in a normal condition. During a fit there are many changes of wave form and further analysis of these may lead the medical profession to a greater understanding of this dreadful complaint.

The electro-encephalograph has a great future, and has given great stimulus to the study of brain disorders. It is useful in diagnosing head injuries, in the study of mania, dementia and other forms of insanity. It has opened up avenues which may alter entirely the methods of treatment of brain disorders.

Although the results obtained from the electro-encephalograph border on the mysterious and spectacular, there is another instrument widely used, which is of tremendous value to the medical profession and its patients. This is the electrocardiograph.

This instrument is used to detect and analyse the electrical currents generated by the contraction of the heart.

That such currents exist is equally as surprising as their existence in the brain.

Previous to the introduction of this instrument examination of the activities of the heart were made by means of the pulsations of the jugular vein. These records were tracings on smoked paper or by means of an ink writing pen of the pulsations of the various hearts, healthy or otherwise.

HEART CURRENTS

Waller was the first worker to demonstrate that the contraction of the heart produced electrical currents. This was in 1887, and it wasn't until 1903 that a sensitive galvanometer was used first by Einthoven. This is now modified into the electrocardiograph.

Small electrodes of German silver, about three inches square, are placed in contact with the skin. The electrical impulses are fed from this similar to the electro-encephalograph and the resultant waves analysed.

There are usually four leads. Number one lead is from the right and left hands. Number two lead from the right hand and left foot, number three lead from left hand and left foot and number four from the chest.

The various kinds of waveforms caused by irregularities in the heart's beat have been tabulated extensively. These are of immense value in determining the type of heart trouble from which the patient suffers.

The diagnosis of heart disease and its subsequent treatment has been enormously simplified by means of this instrument and many people today owe their lives to it.

Accuracy of corpenter's level easily checked

BECAUSE of the waste of time and money, an inaccurate carpenter's level can cause, always check the settings of a newly-purchased level before using it on a job of any consequence. Naturally, the best way to do this is simply to lay the tool on a surface that is known to be level. However, the tool can be checked almost as easily on a surface that is not absolutely level.

After selecting a flat, firm surface, place the tool on it and note exactly where the bubble settles in the level glass. Then turn the tool end-for-end, and carefully tawe another reading.

If the two readings are exactly the same, the tool is set accurately, but, if the readings vary, the level glass requires a corresponding adjustment. To check the setting of the plumb glass, follow the same procedure, using a vertical surface.

SIGNAL GENERATORS

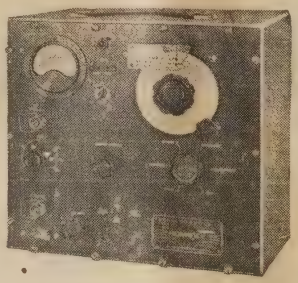
BY "ADVANCE"

Designed for the discerning radio service engineer, the Type "E" Signal Generator is a robust, portable instrument of exceptional dependability. This high performance is due to the design being based on standard signal generator technique. Its range is sufficiently wide to cover all present needs and likely developments in the servicing and design of radio and television receivers.

The frequency coverage is 100 Kc/s-60 Mc/s in 6 ranges plus 60-120 Mc/s using the second harmonic of range "A." Accuracy is guaranteed to be within plus or minus 1%. Internal modulation is 30% at 400 c/s. A.F. output is variable from 0-5 volts. The accurate attenuator system embodies a non-inductive slide wire followed by a 5 decade 75 ohm ladder network. Use of a 75 ohm cable correctly terminated ensures that there are no reflections due to mis-match. This arrangement means that the output voltage at the dummy aerial is accurate and also helps to overcome the problem of poor attenuation at frequencies above 10 mc/s. Stray leakage is less than 3 microvolts at 60 Mc/s.

An illuminated directly calibrated dial with a scale length of over 30" is provided and this is easily and accurately set by means of a slow motion control with a reduction ratio of 10-1.

WRITE FOR DETAILED SPECIFICATIONS



A SUB-STANDARD SIGNAL GENERATOR, TYPE "B4," is available in two models with a frequency coverage of 100 Kc/s to 70 Mc/s and 30 Kc/s to 30 Mc/s respectively. The standard Advance decade step attenuator, accurate at frequencies up to 300 Mc/s, is used, and output from this is matched through a 75 ohm transmission line to the termination pad and standard dummy aerial network. Stray radiation is less than 1 microvolt.

Internal modulation, variable up to 50%, and also R.F. output, may be monitored by a crystal voltmeter. A 400 cycle A.F. output is available up to 15 volts and provision is made for external modulation.

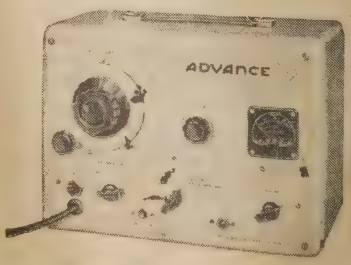
Calibration is accurate to within plus or minus 1% and output to within plus or minus 1db. The direct reading dial is clearly engraved and setting is facilitated by a high quality slow motion drive, making this the ideal instrument for laboratory and production applications.

IMMEDIATE DELIVERY

Specially developed for both radio service and factory production engineers, the Type "F" Audio Generator has a frequency range of 0-10,000 c/s and is of particular interest. The range 100c/s-10,000 c/s is substantially level due to the use of a well designed negative feedback network and accurately calibrated to within plus or minus 2%.

Power output is approximately 1 watt into a matched load of 600 ohms, 5 ohms or 10 ohms attenuator and is monitored by a 2 range rectifier type meter. Total undesired signal is less than 3% at full output.

The dial is directly calibrated and is provided with a high quality drive, making this a particularly flexible instrument for audio frequency measurements.



Sole Distributors:

JACOBY, MITCHELL & CO. PTY. LTD.

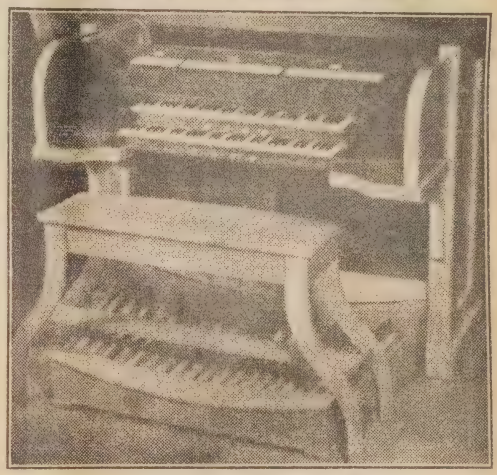
477 KENT ST., SYDNEY. MA5058-MA9569-0

Manufactured by: ADVANCE COMPONENTS LTD., Great Britain

Technical Review

NEW "PIPE" ORGAN HAS NO PIPES

A new all-electric organ has been designed which similates pipe tone so closely that it confuses even highly trained observers. Like the well-known Hammond instrument, it uses rotating tone wheels, but has specially shaped pole tips which generate the fundamental pipe tones directly. A huge amplifying system ensures adequate sound intensity without electrical distortion.



Console of the two manual pipeless organ. Wiring underneath and behind the manuals is similar to that of a large telephone switchboard. As far as the organist is concerned he could equally well be playing an electrically-controlled acoustic instrument.

☆

The characteristics of the new instrument are best appreciated by contrasting it with other electronic organs.

The Hammond organ, best known of the modern electronic instruments, makes little attempt to follow traditional organ practice, apart from the physical arrangement of the manuals.

Specially shaped tone wheels generate fundamental sine waves which can be mixed electrically and given certain reverberation characteristics to produce a virtually unlimited range of tone colors. Although certain prearranged stops are available, the player can "construct" the required tones by adding harmonics at will, using a series of stepped draw-bars.

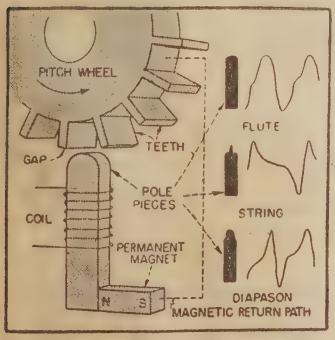
The attack and decay are virtually instantaneous—a characteristic which is variously appreciated or deplored according to the type of music being played. It can be disguised to some extent by artificial reverberation in the amplifying system and by fingering techniques. Tremulant effects are also produced electrically, in some cases, a very wide control being possible.

Very obviously, a successful Hammond player must understand the functions of the instrument and the technical aspects of tone color—this, in addition to basic training as an organist.

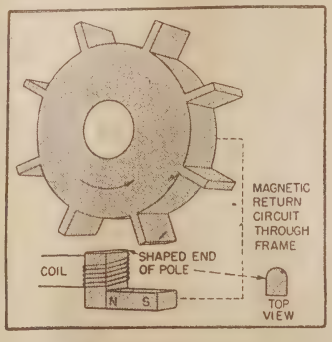
The new design has been developed by J. D. Goodell and Ellsworth Swedien, and is described in the August, 1949, issue of "Electronics." Their objective has been to produce an instrument which looks and plays and sounds like a conventional pipe organ, but avoiding the necessity for banks of pipes, windchests, swells and the other paraphernalia of a conventional organ.

The designers have not sought to compete with the special characteristics of the Hammond.

The rotating wheels set the pitch rather than the tone, and no attempt is made to impart to the teeth or vanes the special shape necessary to produce sine wave output. Instead, the pole faces are shaped to produce directly the desired organ tones and the alternative methods of approach are illustrated.



One method of generating directly the complex waveform is to shape the pole pieces so that the air gap varies as the tooth moves past the tip.



Method actually employed involves a large area pole face with slots or grooves to produce the required waveforms. The air gap is substantially constant.

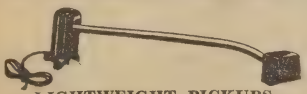
PICK-UP COILS

It is possible to group several pole assemblies around the periphery of a single wheel, the number being limited purely by physical dimensions of the components.

Pitch wheels with 1, 2, 4, 8, 18, 32 and 64 teeth are assembled on a single shaft, so that each wheel corresponds to a single octave of a single note. The shaft is made of non-magnetic stainless steel, with brass spacers between wheels to prevent interaction between the magnetic circuits.

GOLDRING QUALITY PRODUCTS

PRICE LIST



LIGHTWEIGHT PICKUPS

121 with Sapphire £3/13/10
121 without Sapphire .. £3/1/8
122 (Bronze) with Sapphire £3/13/10
122 (Bronze) without Sapphire £3/1/9
123 (Cartridge type) with Sapphire £3/13/10
125 for Standard Needles £2/17/-

BANTAM PICKUP
("Almost" Lightweight)
130 .. .. £2/1/2

HYPERFIDELITY PICKUPS
HEADMASTER, complete with 3 cartridges, Tonaliser and Transformer £10/14/6

AVAILABLE SEPARATELY.
Replacement Cartridge .. £1/8/6
Tonaliser £2/16/-
Transformer £2/6/9
16in. Arm only £1/19/6
Cartridge Arm £1/8/6

Replacement Heads for all Garrard Record Changers from RC4 to RC70

G.1 with Miniature Sapphire (Lightweight) £2/15/9
G.2 for Standard Needles £2/5/3

STANDARD PICKUPS

100 .. .. £2/5/6
100/Ivory £2/9/6

GOLDRING SAPPHIRE NEEDLES

The Precision Jewel Points, made to most exacting limits by experts with many years of experience.
All types, 13/6 each.

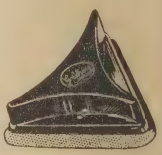
S/1 STRAIGHT
(for Crystal Pick-ups)

S/2 TRAILER
(for Pick-ups to 2½oz. needle pressure).

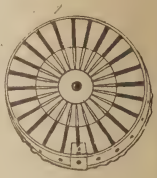
S/4 NEEBEND
Most suitable for Record Changers.

S/3 MINIATURE
for Goldring as well as other lightweight Pickups.

CLEANING PADS
Attractive and Useful. Preserve your record by keeping dust out of the grooves, each 5/-



MINIATURE STEEL NEEDLES
In ingenious Dispenser (1 needle drops out at a time). For all lightweight Pick-ups.
24 Needles . 5/-



RADIOGRAM NEEDLES (10 PLAYINGS)

In attractive Ivory Plastic Box. PER 100 NEEDLES, 2/2.

STANDARD STEEL NEEDLES

Loud Tone, per 200 Needles, in plastic box 1/9
Extra Loud, per 200 Needles, in plastic box 1/9
Medium, per 200 Needles, in plastic box 1/9
Soft Tone, per 200 Needles, in plastic box 1/9

For Technical Information please write to Service Dept.

GOLDRING ENGINEERING (A/SIA) PTY. LTD.,
57 H.E. AREA, ST. MARY'S N.S.W.

LARGE AMPLIFIER PREVENTS OVERLOAD, DISTORTION

Magnitude of the amplifier system is suggested by this set for a private home. A separate amplifier and speaker system replace each bank of reeds, so that sound emanates from wide front. The system can also be used for gramophone and radio reproduction.

A total of twelve shafts, with seven pitch wheels on each shaft, produce all the fundamental frequencies of the organ keyboard. However, to produce the extreme 2, 4, and 32ft. pipe pitches, a couple of additional tone wheels have been added to each shaft.

The number of magnet assemblies grouped around each tone wheel sets the number of basic stops and the output from the coils can be fed as necessary to any or all of the manuals.

In the two manual organ illustrated, two complete generator assemblies are provided. In the lower bank, the pitch wheels are each provided with four pole assemblies providing the basic flute, diapason, string and trumpet tone colors.

The upper bank has only two pole assemblies per wheel, corresponding to the flute and string tone color. The upper bank is also tuned slightly sharp with respect to the lower bank and represents the celeste stops. This is in line with conventional organ practice, except that many have only a string celeste, not flute.

DRIVE SYSTEM

The tone wheel shafts are driven by rubber-tyred wheels which ride on cone-shaped wooden driving blocks. A system of slots and clamping bolts makes it possible to move the driven wheel along the surface of the cone, thus varying the speed and frequency of the generators.

A tremulant effect, involving a frequency variation, is provided in a novel manner on the lower generator bank. The main drive shaft is itself driven from the synchronous motor, via a flexible spring coupling. The shaft carries a flywheel which normally maintains the speed constant.

A braking arm rests permanently against the surface of the flywheel, being pivoted at one end and carrying an electromagnet at the other. An eccentric shaft rotates slowly near the face of the electromagnet. When the latter is not energised the braking effect on the flywheel is constant.

Operating the tremulant control on the console, however, energises the electromagnet, which is periodically attracted to the eccentric shaft. This produces a periodic braking effect on the flywheel and mechanical energy is stored and released in the driving spring. Thus, the speed of the flywheel varies up and down and introduces a component of frequency modulation into the output.

SLOW ATTACK

The "attack" problem has been overcome by substituting diminutive attenuators for the conventional contact switches under the notes. The attenuator is a straight resistance strip and the spring contact riding against it is controlled by pressure of the key. Thus, it takes any note the same time to build up from zero to maximum amplitude as it does to depress the key to its full extent.

While the method overcomes the objection of instantaneous attack, it also renders the instrument touch conscious so that additional control over both attack and volume is available by the very way in which notes are played.

The authors point out that the nature of the organ leaves room for elaborations which in an acoustic instrument might demand a complete new rank of pipes. Thus, by providing special contactors under the keys, it would be possible to make the harmonic content of a note differ initially from the sustained tone, as for the French horn. The whole balance between the manuals and pedals can be varied by faders.

Close up of one generator assembly. Note the rubber tyred wheel bearing against the wooden cone.

Coming to the amplifiers, the acoustic power output of a large pipe organ is greater than most people realise. In general, it is desirable to be able to produce with full organ a minimum of 100 decibels above the reference threshold.

SPEAKER SYSTEM

Perhaps the most important pedal stop is the 16-foot bourdon (a relatively pure flute tone). To produce it from a loudspeaker system at full pipe organ level requires carefully designed enclosures and exceptionally clean power amplifiers.

In a typical church installation, where the seating capacity was around 1500 and the reverberation time relatively low, 100 watts of electrical audio power fed to five efficient loudspeaker systems (consisting of a total of 130 loudspeakers) was required for satisfactory results.

The only really satisfactory subjective criterion of performance in audio work is direct comparison. In the installation described above it was possible to make such a comparison with a three-manual pipe organ having 18 ranks of pipes. The test was made with 15 observers. All but two of the observers were critical listeners thoroughly familiar with pipe-organ tonal attributes.

Several of the engineers admitted that their judgments included an intimate knowledge of characteristics in the organs that had little to do with the quality of the tone. Even with this added factor, no single score was high enough to be significant of anything except the close similarity in the basic character of the instruments.

NOW! The

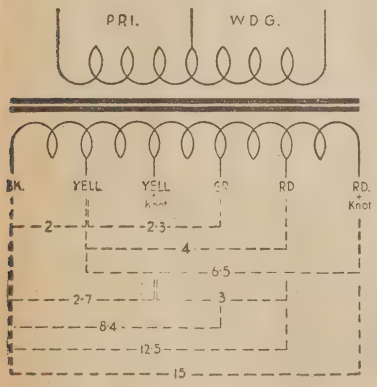
Extended Impedance Series

A new series of output transformers with multi impedance tappings to match any popular speaker.
Engineered by Ferguson laboratory!

FREQUENCY RANGE

50-8000 cps.
Low insertion loss on all outputs.
With a range of Primary impedance to match popular valve combinations.

Secondary Impedance Connections



TYPE	PRIM. Z	WATTS
OP 54	5000 2500 SE	10
OP 55	5000 PP	15
OP 56	6600 PP	15
OP 57	10000 PP	15
OP 58	5000 6600 10000 PP	15
OP 59	5000 6600 10000 PP	25
OP 60	5000 6600 10000 PP	32

Secondary Impedance available on all types

2	2.3	2.7	3	4
6.5	8.4	12.5	15	

Obtained by selection of windings as shown in the diagram.

Engineered TO-DAY for TO-MORROW'S requirements

-FERGUSON-

TRANSFORMERS PTY. LTD.

Ferguson Lane, Chatswood, Sydney, N.S.W. JA 2877

Available at all leading wholesalers throughout Australia and Tasmania. If you have any difficulty obtaining supplies, contact us direct.

P.T.12

CORONAGRAPH MAKES SOLAR ECLIPSE

To assist in study of the sun, a device has been developed which makes it possible to undertake detailed observations of the corona, or outer envelope of the sun, which formerly could be studied only during times of total eclipse. The device known as the coronagraph is one of the most ingenious of astronomical instruments. It is illustrated here in diagram form.

DESIGNED by the French astronomer M. Lyot, the coronagraph produces an artificial eclipse of the sun and so makes the corona visible. As the corona has only about one-millionth of the brilliance of the sun itself, it is normally blocked out and cannot be observed. Discovered during natural eclipses, the corona has long been known to be of the utmost importance in study of the sun, but until the coronagraph was produced it was possible to observe it only by fitting out costly expeditions to remote places where a total solar eclipse was to take place.

With the coronagraph, the inner ring of the corona can be observed and studied on any clear day, from a suitably elevated observation point. It is necessary to operate the instrument from a mountain so that the ray-scattering effect of the dense lower atmosphere will be avoided.

The coronagraph consists of a long tube, about 9in in diameter, fitted with an adjustable diaphragm in the front end, behind which is a lens. Farther back along the tube is a small blackened plate mounted on the front of a second lens.

CORONA IMAGE

The image of the sun cast by the lens is made to fall precisely on the plate, while light coming from around the sun's image continues down the tube. As a telescope lens produces, by diffraction, a bright ring of light around the lens rim, provision is made in the coronograph to remove this. It is trapped by a baffle plate farther down the tube. This plate has a circular hole in it which allows the beam of light from the corona to pass through to the camera placed at the end of the instrument.

A clear picture of the vivid solar "atmosphere" results. This speeds up the astronomer's study of the corona to a remarkable extent, for one day's observations, covering eight hours or so, are equal to the observations that can be made by astronomers in natural eclipses eventuating in a century or so.

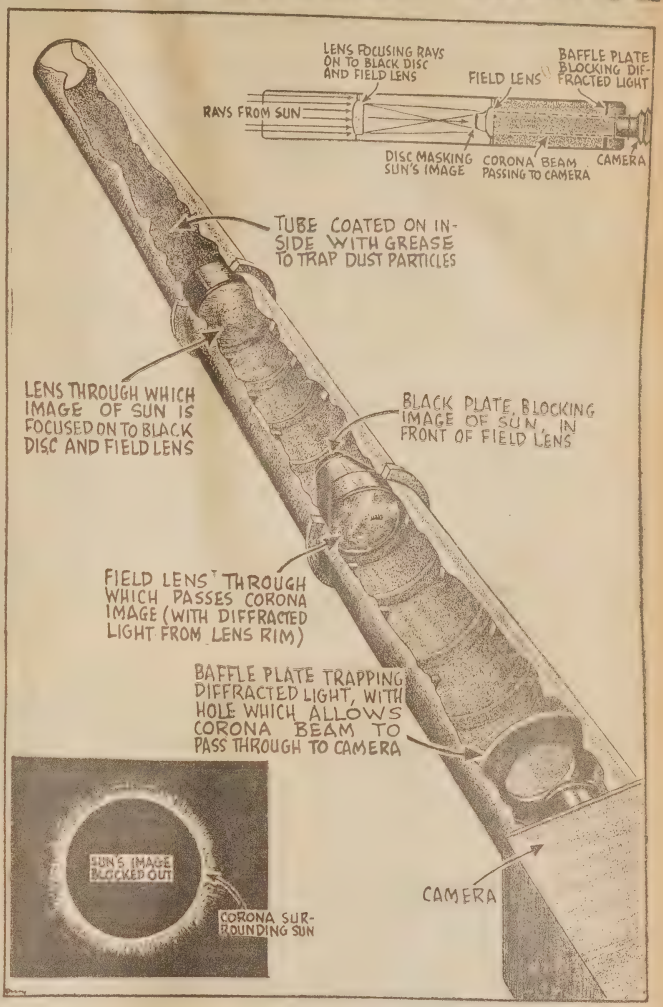
Scientists believe that the corona, through which all the sun's energy must pass on its way into space, is probably an important part of the safety-valve mechanism that keeps the sun's energy consumption stable. The corona does not form part of the sun's surface, nor does it share in its rotation. It is probably formed by streams of atom particles shot out from the atomic power plant which the sun forms.

It has been found that the solar "atmosphere," which is thousands of miles thick, is at astonishingly high temperatures—apparently very much hotter than the sun's surface itself, estimated at 12,000 deg. Fahr. The sun is entirely gaseous in form, but its huge gravitational effects have caused the central body to become compressed, so that there is a sharp line dividing the solar body from the tenuous, hot corona.

The coronagraph, acting as the lunar disc does during a total eclipse of the sun, reveals the corona as a flaming, nearly circular, halo around the sun. If it is photographed by means of a spectroscopic attachment in the red and green spectral light of vaporised iron, it is found to be a scarlet blaze at least twice the size of the diameter of the sun's body.

While the corona itself is relatively quiet, seething activity is to be observed around the sun's rim as at frequent intervals great eruptions occur, throwing out into the corona tremendous quantities of heavier, filamentary material. The erupted material, weighing millions of tons, moves at speeds reaching hundreds of miles a second.

The blazing prominence arches then stand out in the corona, suspended for hours or days in intense but opposing forces of attraction and repulsion—magnetic, electrical and gravitational fields. Finally it falls back into the sun.

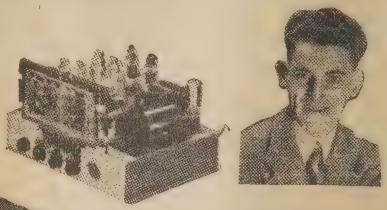

LENS FOCUSING RAYS ON TO BLACK DISC AND FIELD LENS
FIELD LENS
BAFFLE PLATE BLOCKING DIFFRACTED LIGHT
RAYS FROM SUN
DISC MASKING SUN'S IMAGE
CORONA BEAM PASSING TO CAMERA
CAMERA
TUBE COATED ON INSIDE WITH GREASE TO TRAP DUST PARTICLES
LENS THROUGH WHICH IMAGE OF SUN IS FOCUSED ON TO BLACK DISC AND FIELD LENS
BLACK PLATE BLOCKING IMAGE OF SUN, IN FRONT OF FIELD LENS
FIELD LENS THROUGH WHICH PASSES CORONA IMAGE (WITH DIFFRACTED LIGHT FROM LENS RIM)
BAFFLE PLATE TRAPPING DIFFRACTED LIGHT, WITH HOLE WHICH ALLOWS CORONA BEAM TO PASS THROUGH TO CAMERA
SUN'S IMAGE BLOCKED OUT
CORONA SURROUNDING SUN
CAMERA

ALL TYPES OF EQUIPMENT
for the Radio
ENTHUSIAST!

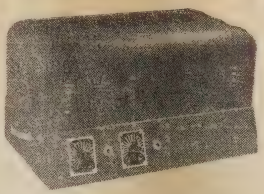
with these outstanding services

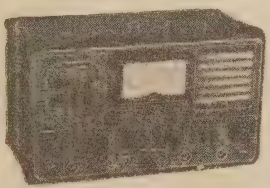
Yes, we supply all types of gear for the radio enthusiast, and because we are radio engineers as well as wholesalers, we understand your every technical requirement.

RADIO KIT-SETS. Yes, we specialise in kits for "R. & H." circuits and have designed many well known circuits ourselves. All kit enquiries and orders receive the personal attention of Mr. Don McEvoy, Radio Technician who has a wide experience of kit construction. A free price list is available, listing over 40 different radio kits.



AMPLIFIERS. For the public address man and hi-fidelity enthusiast, we have a complete range of amplifiers which are available in kit form or completely built. A free descriptive booklet and price list is available on request. Also listed are prices for most "R & H" amplifier designs.





TEST EQUIPMENT. Whether you are a technician requiring elaborate testing apparatus, or a hobbyist in need of a simple test instrument, Electronic Parts can supply your requirements. We not only supply the gear itself, but thoroughly understand the operation and design of each instrument and can help you with technical information about test gear. Illustrated brochures of "University" test equipment are available upon request.

Yes, we carry large stocks of all types of radio replacement parts. Our Radio Repair Department is maintained for the convenience of hobbyists, amplifier enthusiasts, and the trade.

MAKE ELECTRONIC PARTS PTY. LTD. YOUR SUPPLY HOUSE FOR 1950

Send Coupon for Descriptive Literature

(Mark X against item which interests you).

- ☐ RADIO KIT SETS
- ☐ TEST EQUIPMENT
- ☐ AMPLIFIERS

NAME .. ..

ADDRESS .. ..

.. ..

(No obligation on your part) Please enclose stamp to cover postage.

ELECTRONIC PARTS PTY. LTD.
E. S. & A. Bank Building
BROADWAY, N.S.W.
Phone: MA 1661

NEWS AND VIEWS OF THE MONTH

U.S. Color Television

It is often interesting to observe the reactions of non-technical and businessmen to our radio problems.

The following extract from the American journal, Editor and Publisher, provides some extremely pertinent commentary on the position in USA.

"John Crosby, the New York Herald Tribune connoisseur of the ether, popped a question to the panel of radio-television experts at the American Association of Advertising Agencies.

"Who wants color television?" the noted critic asked.

The only answer came from Paul C. Raibourn, vice-president of Paramount Pictures and treasurer of the DuMont Laboratories. Said he, in effect: Some members of the Federal Communications Commission believe the public is entitled to know the whole story of color TV, so hearings are being conducted now in Washington.

The record of that hearing would indicate that the proper setting for it is in Domestic Relations Court, since compatibility is a main issue. The incompatibility of the witnesses would be ground for divorce in many States.

TWO SYSTEMS DEMONSTRATED

After preliminary remarks as to their respective desires to bring color video out of the laboratories, Columbia Broadcasting System and Radio Corporation of America got around to demonstrations of two different color transmission systems.

The CBS six-hour show in a hotel ballroom included "a dramatic test of color television pickup from a studio in which the light was so dim that it was inadequate for reading." CBS officials said the color pictures had travelled close to 500 miles over coaxial cable from Washington to New York and return, with no loss of color fidelity.

Dr. Allen B. DuMont, whose firm recently opened the world's largest television receiver factory, called a Press conference while the CBS show was still going on, and told newsmen that he hasn't seen a system that's even "warm." It will take 10 to 20 years to develop a satisfactory color system, he asserted.

STANTON Vs DU MONT

A quick retort came from Dr. Frank Stanton, CBS president, who branded Dr. DuMont's statement as evidence of his continued attempts to keep color television from the public.

"Let the FCC try the case," Dr. Stanton pleaded.

After RCA presented its all-electronic system, Dr. DuMont announced that the tests had "confirmed" his views that neither system is ready for the public. Color TV, he declared, isn't coming out of the FCC hearing room; it will come from continued development work in the laboratories.

RCA engineers tried to show that color could be added without obsoleting present black-and-white sets. The RCA system, it was explained, is compatible—which means that present b-and-w receivers can get color programmes in b-and-w without any modification. On the other hand, a color set will receive b-and-w pictures as well.

This feature of compatibility was held to be of great importance to the economics of television.

Dr. DuMont charged, however, that when a station sent out a b-and-w show at his request the color sets picked it up in the form of tinted

RADIO CROSSWORD PUZZLE, No. 28

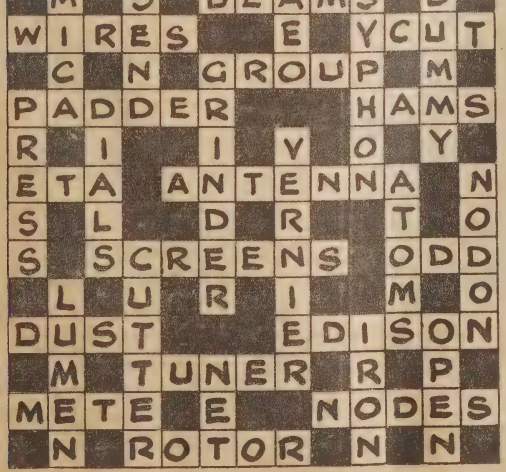
ACROSS

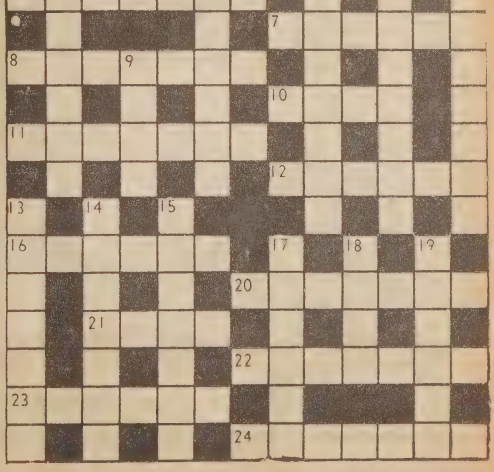
1. Valve element.
7. Unit of luminous intensity.
8. Simplest of all receivers.
10. Character of sound.
11. Type of oscillator circuit.
12. Falling star.
16. Shield.
20. Parts which furnish energy.
21. Once round a coil former.
22. Electromotive force.
23. Radioactive element.
24. Accumulator.

DOWN

2. Antenna.
3. Retailer.
4. Half-wave antennas.
5. Resistor that discharges power supply electrolytics.
6. Type of gaseous conduction rectifier.
9. Radios.
13. Having no magnetic property.
14. Smallest quantities of positive electricity.
15. Type of oxide cell.
17. Purple light caused by ionization.
18. Jogging pace.
19. Ohmmeter for high resistances.

BELOW—LAST MONTH'S SOLUTION





The Aegis METROPOLIS "4" was always a WINNER

NOW it's even BETTER!

Your favourite Aegis 4 valve Broadcast Kit assembly has been rejuvenated! In appearance, simplicity and in price the Aegis' Metropolis "4" is today's sensational news! Attractive new features include:—

IMPROVED **APPEARANCE**
The original Plastic Cabinet has been redesigned along more modern lines. Vastly improved in appearance, and more durable than ever before.

IMPROVED **CIRCUIT**
The main improvement here is the inclusion of the new Radiotron series of Valves: X61M, 6AR7GT, KT61, 5Y3GT Rectifier.

IMPROVED **PERFORMANCE**
By the inclusion of these new Radiotron Valves, the sensitivity is increased tremendously, and the usual Aegis high standard quality I.F.'s, Coils, etc, make the Metropolis "4" a true winner in Mantel Kit Sets today

AEGIS
MANUFACTURING COMPANY PTY LTD

PRICE: Including Tax **£10/2/6**
VALVES EXTRA

208 Lit. Lonsdale St., MELOURNE

— Distributors in Every State —

pictures and colors varied on each set.

DISAPPOINTED WITH QUALITY

Reporting the RCA demonstration, Joseph M. Guilfoyle, of the Wall Street Journal, said: "Many impartial observers expressed disappointment over the quality of the color pictures. . . . In one instance a lavender flower appeared with a reddish tinge. In another, the background in one scene was of varying hues on the three different types of receivers—all laboratory models."

Dr. Peter C. Goldmark, developer of the CBS color system, said manufacturers would tell the FCC that a self-contained, table-model CBS-type television receiver giving both color and b-and-w pictures in 10-inch size, can be made to sell for 220 dollars. And they did.

Dr. Goldmark asserted the RCA two-color (blue-green and orange) receiving system "does not merely fall short of achieving color fidelity, but in fact does not achieve even a semblance of it."

As for a second question, which Mr. Crosby put to the experts—"Who ever wanted television anyway?"—Mr. Raibourn volunteered this answer: The English were getting so far ahead of us, we had to move along.

Just a British scheme to devalue our radio dollar?

VOICE COIL FILTER

Error Note

An unfortunate drawing error occurred in the filter circuit on page 37, which was not noted until the centre section of the magazine was printed. The moving contact of the right-hand switch section should be taken to the upper voice coil terminal. The lower voice coil terminal should go to the common earth return. Make this amendment now to avoid confusion.

Radar Chases Meteors

AN exciting account of the use of radar to chase meteors was given by Dr. A. C. B. Lovell, of Manchester University.

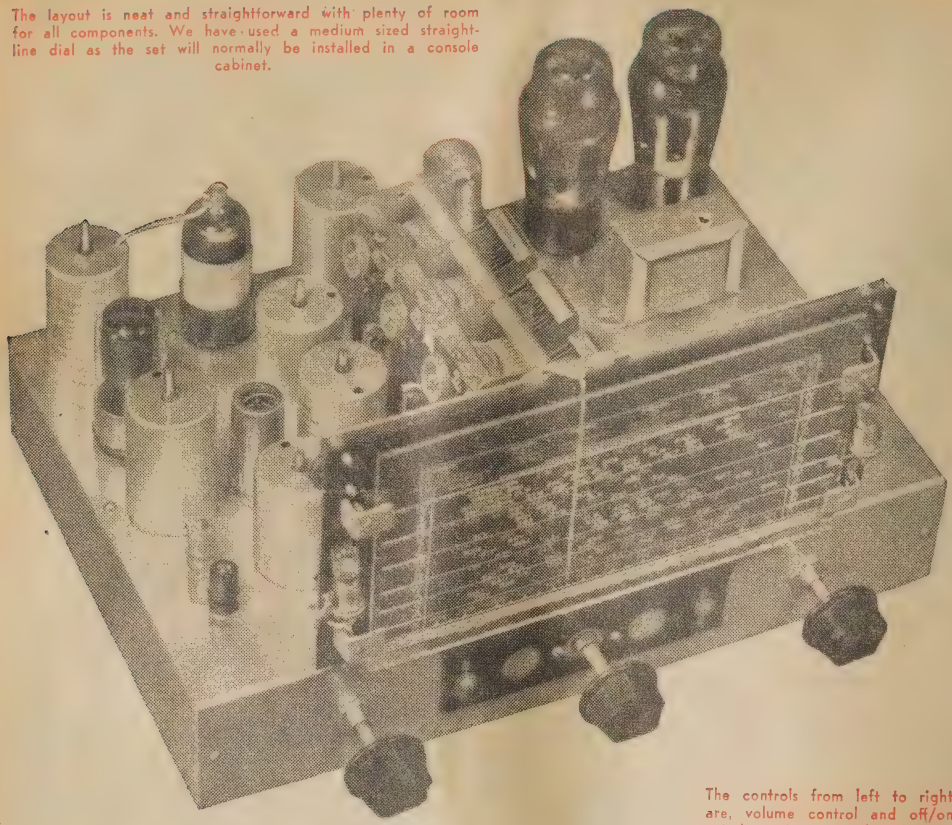
Dr. Lovell, a member of the team that produced H-2-S, the blind bombing device, sought three years ago to apply his radar experience to the tracking of sources of cosmic showers.

Radar pulses were sent out to get echoes from these cosmic ray points in the upper atmosphere, but the records produced strange results.

The "interference" was identified as meteor tracks that were as recognisable by radar in daylight as they are by eyesight at night. Although invisible, they left behind them electrical slip-streams which radar could pick up.

"CAPE HAWKE CALLING, SIR!"
Designed to provide reliable oral communication for small craft for limited distances (intership or land), the radio telephone set has proved its usefulness by its convenience and efficiency.
Easily operated and small in size, it derives its power from a 24v. battery, and can be installed in a very limited space. The radio telephone has a range of 50 miles, and can be remote controlled from up to 50 yards distance.
In all types of communication systems, from the largest telephone exchanges to the smallest units, IRC Resistors have played an important part. Their outstanding efficiency make IRC the first preference of most Resistor users.
IRC RESISTORS
Sole Agents for Australia.
Wm. J. McLELLAN & Co. PTY. LTD.
BRADBURY HOUSE, 55 YORK STREET, SYDNEY. BX2508

The layout is neat and straightforward with plenty of room for all components. We have used a medium sized straight-line dial as the set will normally be installed in a console cabinet.



The controls from left to right are, volume control and off/on switch, tuning control and tone.

A RECEIVER FOR 32 VOLTS

Designing a receiver to operate solely from 32 volts DC is quite a problem in its way. Its solution will not only interest all receiver enthusiasts, but be of great value to the country man who is obliged to use such a supply. It has adequate output and plenty of sensitivity.

by Maurice Findlay

THOUSANDS of 32-volt lighting plants are giving efficient service throughout the country. Electric irons, toasters, soldering irons, fans, &c., for 32-volt operation are standard items, but the design for a 32-volt radio has been lacking. In many cases people with lighting plants have been operating their radios from separate batteries or, at best, periodically exchanging them with batteries from the 32-volt bank.

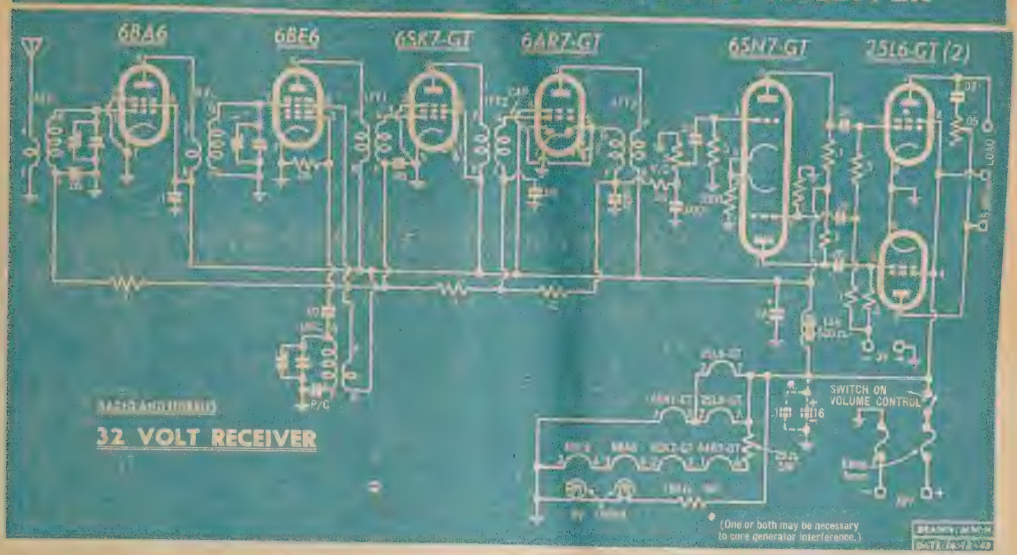
Both methods are irksome and inefficient when a good supply of power is available. It only remains, then, to find a convenient method of using the power.

There are two approaches to the design of a 32 volt receiver with the components now available. One is to use 32 volts on the plates and screens of the valves and accept the reduced power output; gain is not a problem since valve transconductance is still quite good with a low supply voltage.

The alternative is to use a high voltage vibrator. Full high tension voltage is then available and the set can follow along the lines of a normal AC operated set, with the difference that a series-parallel filament network is required. For the experienced constructor who is confident of being able to deal effectively with possible vibrator hash, this approach has advantages.

A rather similar approach, of interest to a limited number of readers, is a 28 volt aircraft genemotor unit. These have been available through disposals sources. Again, except for

CIRCUIT DIAGRAM OF THE 32-VOLT RECEIVER



The circuit is about the simplest we have yet seen for a seven valve receiver. Cathode bias resistors and screen dropping resistors are not required in the tuner section due to the low voltage used. You can touch the high-tension line without getting a shock!

the filament network, the set can follow the same general lines as a normal AC set. Most of these units are very well designed and interference is not likely to be a problem. However, not all readers are in a position to obtain one of these genemotors and, even if they were, replacement parts would become a problem after a while.

With these points in mind, we decided to develop first of all a design for a receiver using 32 volts high tension, and, perhaps later on to consider the design of a vibrator operated version for those of our readers who want a reserve of volume for parties, dances, &c.

A feature of the circuit we finally evolved is its utter simplicity. This is a big advantage to chaps in the country who may not always have a full kit of tools, an electric soldering iron, &c. All the parts used are standard lines with radio supply houses and you will not be obliged to make an extensive search to obtain them. This also is important to country folk who often have to put up with long delays in ordering goods by post.

LOW CURRENT DRAIN

Economy of operation is an important advantage gained by using the 32 volts high tension. Some 32 volt plants are designed primarily to provide lighting and have a limited capacity. If frequent recharging is to be avoided, and the household feel that the radio can be used freely, the current drain must be kept to the lowest possible figure consistent with good performance.

For country operation where reception conditions are often far from good, it is not possible to make any compromises about sensitivity. The set must be sensitive enough to work right down into the noise level, dig out the weak and fading stations and play them on a speaker at comfortable entertainment level. Our completed receiver has a measured sensitivity of 5 microvolts for an output of 50 mW—this without using high gain I.F. transformers and decoupling.

Glancing at the circuit for a moment you will see that it is a full superheterodyne with a high gain RF stage and two IF amplifiers. The audio end consists of a voltage amplifier and phase inverter valve, with a pair of beam tetrodes in push-pull driving the speaker.

Without resorting to special valve types we desired an RF amplifier valve with as much gain as possible in order to mask the mixer noise and provide a good signal to noise ratio overall. We therefore chose the seven-pin miniature type 6BA6. Under normal 250 volt supply conditions this valve has a transconductance of 4.4 mA/volt, about twice that of a 6SK7-GT under similar conditions.

The transconductance does not go down in proportion to the supply voltage. This point was brought clearly to our notice when we were experimenting with high gain IF transformers in the IF stages; but that is another point which we will deal with in turn. The 6BA6 has a variable mu characteristic which is desirable for a smoothly operating AVC system and freedom from cross modulation.

PARTS LIST

- 1 Chassis 13" x 9" x 2½"
- 1 3 Gang condenser.
- 1 Dial (USL 32 or similar, glass to suit gang.
- 3 I.F. transformers (low grain, medium selectivity).
- 3 Trimmers.
- 1 H.T. choke (14H. 500 ohms).
- 5 Octal sockets.
- 1 5 pin socket.
- 1 5 pin plug.
- 2 Miniature sockets (with shield cans).
- 1 Set of coils (Aer. R.F. & Osc.).
- 2 5 amp. fuse holders.

VALVES

- 1 6BA6, 1 6BE6, 1 6SK7-GT, 1 6AR7-GT, 1 6SN7-GT, 2 25L6-GTs.

RESISTORS

- 1 2.0 meg.
- 3 0.5 meg.
- 1 1.0 meg.
- 1 0.5 meg. pot. (with switch).
- 5 0.1 meg.
- 1 0.05 meg. pot.
- 1 2000 ohm.
- 2 0.05 meg.
- 1 150 ohm (3 watt).
- 1 25 ohm (5 watt).

CONDENSERS

- 1 16 mfd. (525 pv.).
- 6 0.05 mfd.
- 1 0.1 mfd.
- 1 0.01 mfd.
- 1 0.02 mfd.
- 2 0.0001 mfd.
- 1 50 pf.
- 1 Padder (see text).

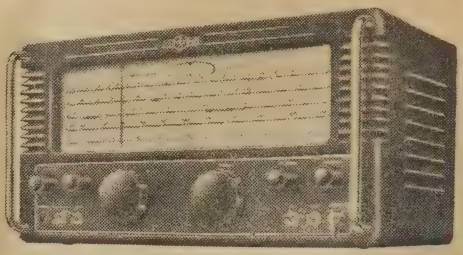
SUNDRIES

- 2 dial lamps (6v. 150 m.a.), hook up wire, shielded wire, power cord, spaghetti, nuts and bolts, solder lugs, tag strips, bracket for bias battery, 2 terminals, power plug, rubber grommets, washers, etc.

Heralding

THE GREATEST AMATEUR COMMUNICATIONS RECEIVER OF ALL TIME . . . the

EDDYSTONE '750'



The "750" is a magnificent model—an entirely new, ultra-modern Amateur Bands Receiver with a host of outstanding features. It is the successor of the famous "640"—thousands of which are in use the world over, including the U.S.A.

Featuring:—

- Coverage 480 Kc/s to 30.5 Mc/s.
- 200:1 ratio dial reduction.
- Modern miniature valves.
- 3 watts of audio.
- Double detection superheterodyne (1600 and 85 Kc/s).
- Stabilised H. T. supply.
- Provision for external S meter.
- Variable selectivity I.F.'S.
- New and improved dial provides ample band spread on amateur frequencies.

AVAILABLE EARLY 1950

Place your order NOW with your Distributor

Further details from:

- VICTORIA: J. H. MAGRATH & CO., 208 Little Lonsdale St., Melbourne.
- WILLIAM WILLIS & CO., 428 Bourke Street, Melbourne.
- N.S.W.: JOHN MARTIN PTY. LTD., 116-118 Clarence St., Sydney.
- QUEENSLAND: CHANDLERS PTY. LTD., Cnr. Albert and Charlotte Sts., Brisbane.
- WEST AUSTRALIA: CARLYLE & CO. LTD., Hay St., Perth, and 397 Hannan St., Kalgoorlie.
- ATKINS (W.A.) LTD., 894 Hay Street, Perth.
- SOUTH AUST.: GERARD & GOODMAN LTD., 192-196 Rundle St., Adelaide.
- TASMANIA: W. & G. GENDERS PTY. LTD., 53 Cameron Street, Launceston, & Liverpool St., Hobart.
- LAWRENCE & HANSON (ELECTRICAL) PTY. LTD., 120 Collins Street, Hobart.
- NOYES BROS. LTD., 36 Argyle Street, Hobart.

Australian Factory Representatives: R. H. Cunningham & Co., 62 Stanhope Street, Malvern, Victoria. Tel.: UY6274.

CALSTAN TEST EQUIPMENT

Since 1931 the name "*Calstan*" has been a guarantee of fine Test Equipment.

THE CALSTAN RANGE INCLUDES:—

TEST EQUIPMENT:
Valve and circuit testers, multi-testers, oscillators, multimeters, etc.

METERS:
Moving coil and moving iron, square and round types.

RESISTORS:
Guaranteed accurate to 1% resistors and shunts. ¼ of 1% shunts to order.

RADIO:
Receivers, radiograms, amplifiers, transmitters, transmitting condensers, etc.

Zenith

Address all trade enquiries to—

RADIO COMPANY PTY. LTD.

131-133 Palmer Street, EAST SYDNEY

A 6BE6, also a miniature type, was chosen to fill the mixer socket. It features a high conversion conductance and high transconductance of the oscillator section, ensuring reliable operation with the reduced high tension voltage. Oscillator grid current exceeds 100 microamps over the whole band.

The IF amplifier is wired along conventional lines. Two stages are desirable to give a reserve of gain and adequate selectivity for country locations.

We decided on a 6SK7-GT rather than a miniature type for the first IF stage more on the grounds of consistency than for any other reason. As yet there is no diode/RF pentode available in the miniature series. However, the newly introduced 6AR7-GT has the required diode and is similar physically to the 6SK7-GT.

FOR THE COUNTRY MAN

There is another small point which may cause difficulty with a set using a large number of miniature valves. We refer to the difficulty of soldering miniature sockets with a large soldering bit, which is often all the country man has on hand. Certainly 32-volt electric soldering irons are available, but there is no guarantee that everyone will have such an iron available when building the set.

Automatic volume control is applied to the RF stage and both the IF stages. There is little point in applying AVC to the mixer, since the extra control obtained thereby is negligible and extra components are required.

A big saving in components and wiring complication is achieved by omitting cathode bias from the valves in the tuner section. This is possible because of the very low plate voltage. In actual practice a small amount of bias is applied to the RF and IF stages under all conditions, due to the AVC voltage developed by both atmospheric and receiver noise. Simple AVC is used, there being little point in complicating the circuit and reducing the voltage on the 6AR7-GT to provide a delay voltage.

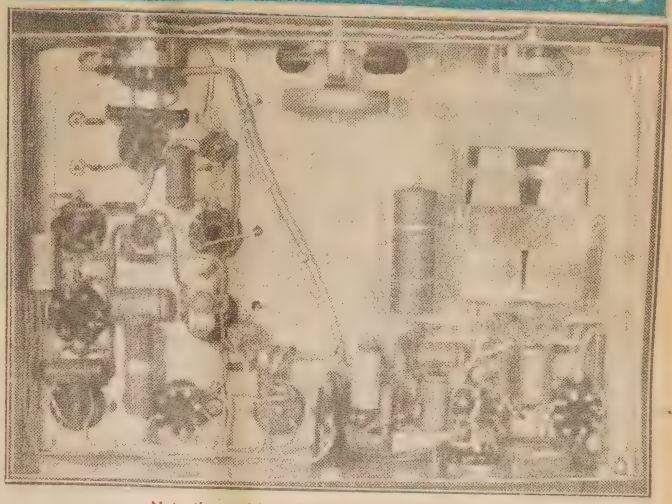
A further simplification in the design is effected by the omission of screen dropping resistors and associated bypass condenser. With low gain IF tranformers no decoupling is necessary for the high tension supply, although we take the precaution of decoupling the AVC line.

CHOICE OF INTERMEDIATES

This matter of IF transformers is most important and we suggest you use low gain, medium selectivity types. The receiver is very difficult to stabilise with high gain transformers. In fact, with high gain transformers in our experimental model it was only just possible to stabilise the set with every stage decoupled, even after special care had been taken with the wiring.

Low gain transformers are available in several brands and you should have no difficulty in obtaining them. Two stages using low gain, medium selectivity IFs give higher gain and better selectivity than a single stage using high gain, medium selectivity IFs. The difference is well worth while.

UNDERNEATH VIEW OF CHASSIS



Note the position of the bias batteries at right.

In this set, the design of the audio amplifier is of special interest. The principal problem is to get adequate power output with the limited high tension voltage available.

Fortunately, we were assisted by the availability of 25L6-GTs which are beam tetrodes, designed especially to operate with moderately low voltages. The performance of the 25L6-GT in this regard is very much better than the 6V6-GT. The push-pull output circuit makes available more power than the same two valves would give if connected in parallel. Also, the parallel connection causes difficulties by requiring a low load resistance.

EQUIVALENT VALVES

Incidentally, the KT32 is a direct equivalent of the 25L6-GT and may be more readily available than the latter. The socket connections of both valves are the same. Actually, KT32s were in the output sockets at the time the set was photographed.

The output valves are operated under class AB1 conditions. Battery, rather than cathode bias is used so that full use can be made of the available high tension voltage. Under these conditions, the power output of the set is little short of 200 mW. before distortion becomes apparent.

To city men accustomed to handling big AC operated amplifiers and talking about power outputs in tens of watts, this may not sound very much. But the same city men would be very much surprised to hear how much noise this set can make when fed into a modern permanent magnet speaker. We can confidently say that the power output is sufficient for most domestic purposes.

Most of the personal portable receivers in use at the present time have a power output in the order of 160 or 170 mW. and it is astounding the amount of volume they are capable of delivering. However, the speaker of a personal portable is working under extremely poor conditions and is insensitive compared with a modern 8, 10 or 12-inch speaker mounted on a proper baffle.

We must insist on this point about the modern sensitive speaker. Speakers designed 10 or 15 years ago, are just not in the race, because the magnets have been improved greatly, even in the last two or three years.

The method of obtaining the balanced drive for the push-pull output stage is worthy of comment.

A possibility, worthy of consideration in certain instances, is to operate the output valves in class AB2. The latter might allow greater power output than the AB1 condition. However, in AB2, the valves draw grid current and a power driver and audio transformer is required. The power driver is easily provided but a good quality audio transformer is both expensive and difficult to obtain. We decided, therefore, to operate the output valves without grid current.

THE DRIVER STAGE

The driver is a 6SN7-GT, one half of which is wired as a normal voltage amplifier and the other is simply to provide the out of phase drive for the second 25L6-GT. The second section does not contribute to the overall gain of the receiver. The grid is tapped into the grid return resistor of the upper 25L6-GT, at a point such that the drive to both output tubes is equal. Appropriate isolating condensers are included so that all valves are operating under correct conditions.

An interesting point is that no bypass condenser is required across the cathode bias resistor of the 6SN7-

"Q-PLUS's" No. 1. 1950 RELEASE

"Q PLUS"

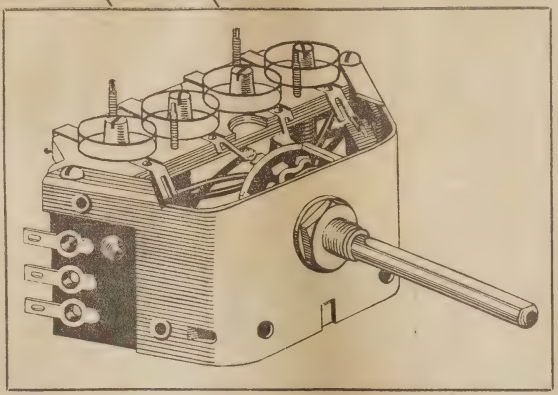
Australia's Smallest Dual Wave Bracket

Available for 550-1630 KC B/C Band, 16-50 Metres, Short Wave Band, it comes in types to cover all popular converter valves, INCLUDING TYPE 6BE6.

Specially shaped to fit into personal portables, portables, midget AC sets or just standard radios —nothing could be finer—**permeability tuned using special "SPHERICAL CARBONYL" Ferro- magnetic cores,** spherical for perfect high frequency insulation, Polystyrene insulated - trimmers mounted alongside cores for ease of alignment. Fully tropic - proofed —in short everything that a 1950 coil bracket demands.

It's good value too, both SW & BC padder condensers being wired in.

Watch for other "Q-Plus" 1950 releases —Support Australia's progressive Radio Components firm— First with midget coils, etc, and first with all worth-while developments.



Illustrated approximately life size—the new "Q-Plus" midget Dual Wave Bracket

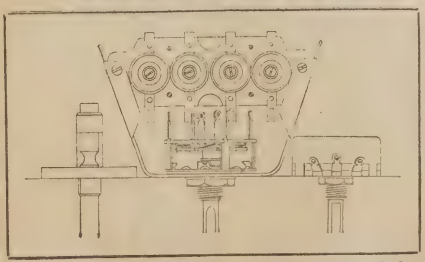
Retail Price 49/6

Type DW4 — 6J8
DW5 — ECH35, 33 or — X61M
DW6 — 1R5
DW7 — 6BE6

NB: This unit now replaces all earlier models.

"Q PLUS"

NOW AVAILABLE



Showing how the volume control and dial spindle fit snugly into position with this "Really designed" dual wave bracket.

From All Leading Radio Parts Houses Throughout Australia

IF YOU CANNOT OBTAIN "Q-PLUS" COILS, IF'S, DW BRACKETS, PLEASE WRITE DIRECT TO THE MANUFACTURERS FOR YOUR NEAREST STOCKIST.

R. W. Steane & Co. Pty. Ltd., Auburn, Vic.

GT, due to the fact that the two sections are in antiphase.

For economical operation, the filaments are arranged in a series parallel network, the total drain being 0.9A. at 32 volts. It would have been possible to include dial lamps in the filament network and so avoid extra current drain for their operation. However, dial lamps are not always as reliable as they could be and a blown dial lamp could put the set out of operation.

In the past, it was possible to buy dial lamps which required only about 50mA. The idea was to wire a resistor to pass 250mA. in parallel with the lamp and both components in series with a 300mA. filament network. Then, should the lamp become open circuit, the filament voltage on all valves in the network would not be low enough to affect the operation of the set.

DIAL LAMPS

However, the most economical lamps available through normal supply channels at the moment require 6 volts at 150mA. If one of these lamps were to be used as above the reduction in filament voltage should it become open circuited would be more than desirable. Therefore, we used two lamps in series supplied from the 32 volt line with a separate dropping resistor.

Having discussed the general circuit requirements, we will go on to consider the layout and construction of the receiver.

The chassis is 13in x 9in x 2½in. It would actually have been possible to use a smaller chassis, but with the present layout there is plenty of room, which makes for easy wiring. The exact size is not likely to be important, since the set will normally be installed in a console cabinet.

With the cabinet in mind, we decided on a modern, edgelit, straight-line dial. There are two types of dial glasses available. One is intended for the Stromberg and the other for the AWA gang. The aerial, R.F. and oscillator coils are also designed to operate with specific gang condensers, so make sure that your coils, condenser and dial glass match.

COILS

If your coils have variable iron dust slugs, use a fixed padder condenser with a capacity of 425mmfd. This particular value is readily available in shops, since it is a standard for broadcast padders. If your coils have fixed inductance, use a variable padder, as shown on the circuit.

Incidentally, if any reader is not sure of the correct alignment procedure for superhet receivers, a pamphlet on the subject is available through the shilling query service.

The layout on top of the chassis is very simple and straightforward, as can be seen from the photographs. Looking at the receiver from the front, the aerial and earth terminals are on the left hand side and towards the front. The aerial coil is next in line across the chassis to the right and then the 6BA6 next to the gang. The socket of the latter is orientated

(Continued on Page 35)

Valve Bargains
New In Sealed Cartons

2A7	14/5	6A8G	14/-
2B7	15/6	6A6	15/8
1D4	12/-	6B7	14/4
1J6	12/-	6G8G	14/4
83 V	14/-	6F6G	13/-

Plus Postage

Potentiometer Bargains

20,000 ohms
30,000 ohms
50,000 ohms
100,000 ohms
} 1/9 ea.

Plus Postage

Electrolytic Condensers

300 Mfd. 6 Volt.	4/4	ea.
400 Mfd. 6 Volt	4/9	ea.
500 Mfd. 6 Volt	4/11	ea.
10 Mfd. 25 Volt.	2/6	ea.
25 Mfd. 40 Volt.	2/11	ea.
8 Mfd. 525 Volt.	3/11	ea.
16 Mfd. 525 Volt.	4/11	ea.
16 Mfd. 600 Volt.	5/11	ea.

Plus Postage

Paper Pigtail Condensers

.01 Mfd. 600 Volt.	9½d	ea.
.02 Mfd. 600 Volt.	9½d	ea.
.05 Mfd. 600 Volt.	11d	ea.
.1 Mfd. 600 Volt.	1/1½	ea.
.1 Mfd. 400 Volt.	1/0½	ea.
.1 Mfd. 200 Volt.	9½d	ea.
.5 Mfd. 400 Volt.	2/4	ea.
.5 Mfd. 200 Volt.	1/6	ea.

Plus Postage

Ferrocart Crystal Set
Complete with phones
Plastic Cabinet
£3/19/6 Plus Postage.

Value for 10/- used parts in box. Include: Resistors, Coil, Condensers, Volume Control, Sockets, Voltage Divider, Nuts and Bolts.

Coil Formers
Marquis 4, 5 & 6 Pin __ 2/3

Q Plus
Midget 1R5 Osc. Coil __ 4/9

Crystal Set Coil
Large, Complete __ __ 5/1

Plus Postage

Used Tuning Condensers
Two or Three Gang _ 5/- ea.

Midget Socket and Plug
Flush Mounting __ __ 1/6 pr.

Used Power Transformers

2.5 Volt	5 Volt
385 Volt	385 Volt

80 Mill 200-240 Primary

4 Volt	4 Volt
385 Volt	385 Volt

80 Mill 200-240 Primary

ONLY 8/6 ea.

Used Block Condensers

.25 Mfd. __ __ .05 Mfd.
.1 Mfd. __ __ __ 1/- ea.

1 Mfd __ __ __ 2 Mfd.
4 Mfd. __ __ __ __ 2/- ea.

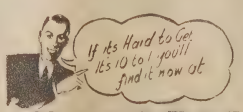
Plus Postage

Remember—We can help you when ordering these lines or others which we carry just for you. Please include postage. Surplus postage returned.

We can supply a Kit Set of parts for your next radio or amplifier. Write for details and price.

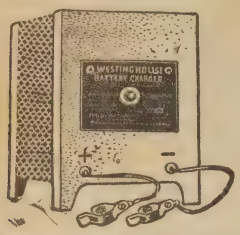
SPECIAL: .08 Pigtail Condensers **6d.** ea.; 5 pin Speaker Plugs **6d.** ea.; 25,000 Dividers **1/6** ea; Padders **1/-** ea.

ALL GOODS PLUS POSTAGE



L.G. WALLACE
108 CHAPEL ST. WINDSOR S.1
VICTORIA

NOW YOU CAN MAKE A TRUE MIDGET RADIO



Famous WESTINGHOUSE BATTERY CHARGERS

6 volt, 5 amp. £6/17/6
12 volt, 3 amp. £7/19/6

Now available for the first time . . .

A full range of miniature 6.3 volt A.C. valves

6AU6	18/6
6AV6	17/6
6BA6	18/6
6BE6	18/6
6AQ5	18/3
6X4	17/6

STROBOSCOPES TO CHECK YOUR GRAMO. SPEED __ 6d.

FERROCART CRYSTAL SETS

Complete with Brown's English Headphones. In Pink, Green, Yellow Plastic cabinets 84/-

NEW W.F. PORTABLE GRAMO-UNIT

Featuring the Collaro rim drive motor and pick-up. Available in blue, brown or buff leatherette.

£11/19/6

GARRARD GRAMO-MOTORS & PICKUPS

Model S	£6 2 6
Model AC7E	£7 15 0
Model V	£9 4 6
R.C.65 Record Changer	£18 0 6

• • •

NEW WEESTAT MIDGET VOLUME CONTROLS WITH D.P. SWITCH—HALF AND ONE MEG. 9/-.

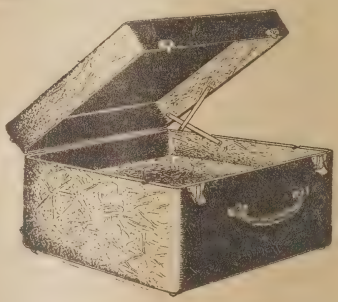
• • •

THIS MONTH'S

SPECIAL

Personal Portable Cabinets—Leatherette covered, complete with carrying handle.

Usually 35/6, few only at __ __ **17/6**



RECORD CHANGER CABINETS

Suitable for any make of record changer. Brown leatherette finish.

116/-

Similar, but for single player motor and pick-up.

90/-

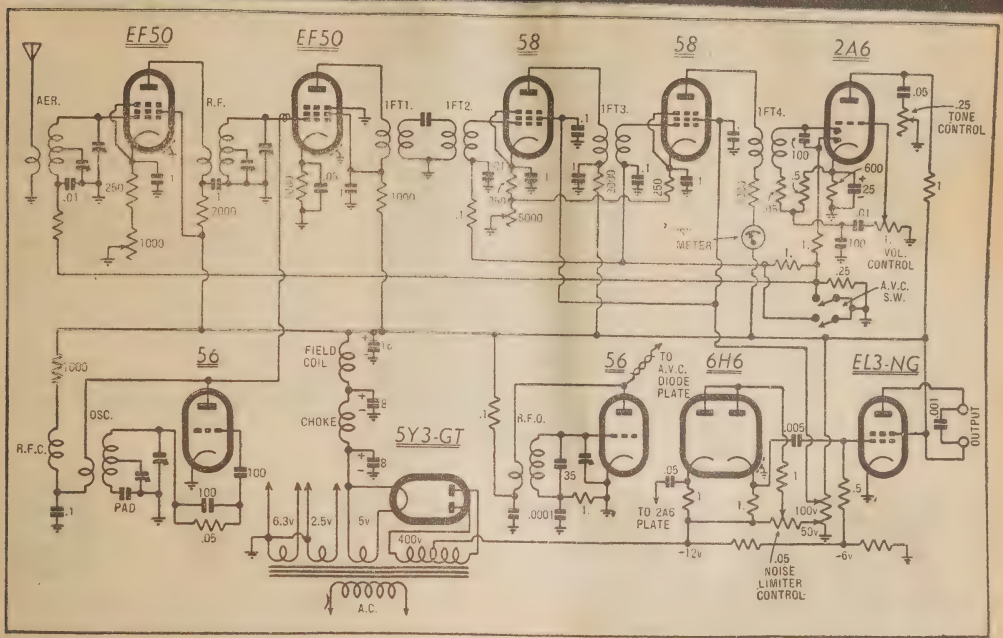
OPEN SAT. MORNINGS **OPEN SAT. MORNINGS**

WARBURTON FRANKI (MELB.) LTD.

380 BOURKE ST., MELBOURNE, C1. . . . PHONE: MU 6355 (8 LINES)

(W.F. Pack FREE, but please include freight or postage with all orders)

FOR THE JUNIOR EXPERIMENTER



This circuit has a combination of features from several R & H designs. It is good effort and should operate well with a few changes as suggested in the article.

Readers have wasted no time in accepting our invitation to send along the circuits for comment. They range from the Ten Valve Communication receiver featured above to little one and two valve sets. Perhaps you, too, would like to try your hand at a design.

WE certainly picked a tough one in this ten-valve circuit submitted by a reader from Woollahra, New South Wales. In general, however, the circuit follows along ordered lines and our criticism is mainly of individual component values.

One must realise, of course, that there is room for varying opinions about circuit arrangements and you may not all agree with our observations. All the same, it will be good practice to examine the design yourself and reach your own conclusions. The circuit has been re-drawn by our draughtsmen, but is otherwise identical with the rough diagram originally submitted.

Perhaps the simplest approach is to consider it stage by stage. First of all, the RF stage.

RF STAGE

One value has been omitted, namely the AVC feed resistor, and the usual figure is 0.1 meg. Our most serious quarrel is with the value of the gain control, shown as 1000 ohms. We would not expect this to give a sufficient degree of control and would suggest the use of a 10,000 ohm potentiometer. The suppressor, incidentally, could be tied to earth instead of to cathode to increase the effectiveness of the potentiometer still further.

Incidentally, the EF50 makes a good RF amplifier for short waves but is not very successful on the broadcast band. Due to its sharp cut off characteristic, it is liable to cross modulation.

THE MIXER, OSCILLATOR

We can find no quarrel with the mixer since, apart from anything else, it is identical with the circuit used in our own "Short Wave Seven." A fairly high value of cathode resistor, will full screen voltage allows the valve to operate as an anode bend detector-mixer. The alternative would be to provide zero or at least very little bias and limit the screen voltage to a point where both screen and plate currents are moderate.

Coming to the oscillator, we generally prefer to use a pentode with cathode, grid and screen providing the active elements and the output taken from the plate. This "electron coupled" system isolates the oscillator from the RF tuning and obviates any problems of oscillator "pulling." The triode scheme, however, is quite workable.

Getting down to details, the RF choke serves no useful purpose, since the 1000 ohm resistor would provide any necessary isolation. In point of fact, the set would probably work just as well with both components omitted.

There is just one point in that a large resistor—say 20,000 ohms—with a 8 mfd electrolytic in parallel with the RF bypass provides useful low frequency decoupling and offers some protection against modulation hum and motor boating.

There is an obvious mistake also in the grid circuit, where the additional 100 pf. condenser isolates the grid from its return resistor. This condenser should be deleted from circuit and the second condenser reduced, preferably to 50 pf.

IF STAGES

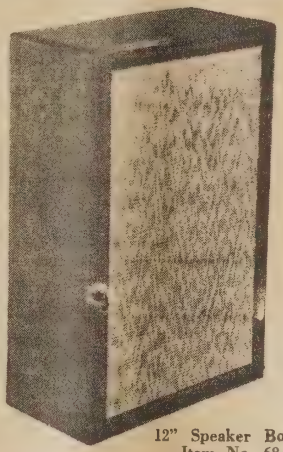
The old 58 valves look somewhat cut of place alongside the EF50's but apart from the base and heater rating, they are identical with the 6U7-G, 6K7-G, &c. The gain is lower than given by the new 6AR7-GT or the 6BA6 but, with two IF stages, high gain is not required from the valves.

The condenser coupling the two back-to-back transformers could well

for the MUSIC LOVER...
from SPECIALLY DESIGNED SPEAKER BOXES

Realism

OUR ENGINEERS HAVE OVER A PERIOD OF TIME DEVELOPED A SPEAKER BOX FOR A 12" SPEAKER FOR USE IN YOUR DRAWING ROOM.

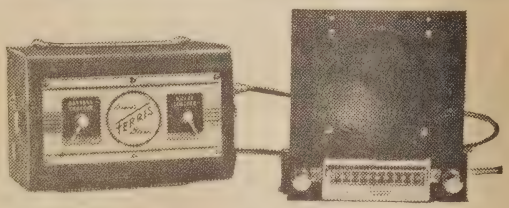


12" Speaker Box
Item No. 68

- A NEAT AND COMPACT CABINET, POLISHED IN ANY COLOR SO AS TO TONE WITH YOUR EXISTING FURNITURE
- SOLIDLY CONSTRUCTED OF FIRST GRADE TIMBER, AND SCIENTIFICALLY PADDED THROUGHOUT, THE BOX MEASURES 24" x 36" x 12".
- *Write for our illustrated literature showing this item and other Sound System Accessories.*

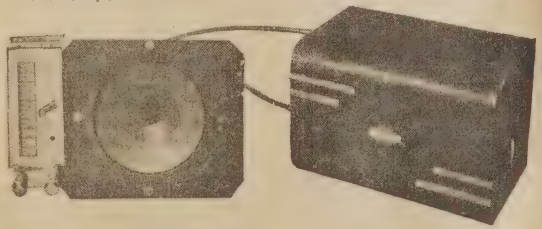
STEANE'S SOUND SYSTEMS PTY. LTD.

Head Office: 60-80 MILLER ST., MELBOURNE. FJ 9140, FJ 9149, FJ 4543
And at 367 Kent St., Sydney. MA 2588, M 3136.



Ferris SUPER SEVEN

It is without doubt the most attractive set yet designed. The Ferris Super Seven is equpped with Electronic Noise Limiter; Adaptor Socket for microphone, pick-up, F.M. or S.W.; Shock Mounted Vibrator, to eliminate mechanical hum or buzz; whilst the Dual "High-low" Battery Drain Switch permits the motorist to regulate reception when a greater volume is required, or if operating a microphone or pick-up, ideally suited for launches, service cars and small buses.



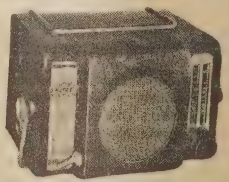
Ferris Model 77

Standard Car Radio for all 6v. and 12v. systems. Supplied with Standard Dashboard controls or special tailor-made units.

These handsome best sellers now include the

FERRIS
SUPER SEVEN
(Model 83)

Australia's most powerful—7 valve—Car Radio, featuring Dual "High-Low" Battery drain, and many other exclusive features.



Ferris Portable (Model 74)

All motorists, especially commercial travellers and business men, will find the Ferris Portable Car Radio a round-the-clock companion when driving, and a boon when plugged into hotel room power points. Its six valves ensure powerful long range reception.

N.S.W. Wholesale Distributors:

B.G BLOCH & GERBER LTD.
WITH WHICH IS ASSOCIATED
THE WELDON ELECTRIC SUPPLY CO.
46-48 YORK STREET, SYDNEY
TELEGRAMS: "LESAD" SYDNEY BX 4221 (10 LINES)

be 10 pf. but most other circuit values are correct.

There is just a point in that the 5000 ohm potentiometer may not give enough variation in IF gain and we would suggest a 10,000 ohm type with the high potential end tapped up to about 35 volts on the voltage divider. Oh, yes, there should be a 0.1 mfd condenser by-passing the B-plus end of 1FT4.

DETECTOR AND AVC

The only obvious omission from the detector circuit is a 100pf. condenser from the "F" terminal of 1FT4 to the cathode of the 2A6.

We suspect, however, that things have become mixed up in the AVC circuit. Only one-fifth of the available voltage is applied to the controlled valves and it would appear that the 1.0 meg AVC feed resistor should connect to the top end of the AVC load—that is, directly to the diode. This would put the full AVC volts on to two IF amplifiers.

It is quite in order to limit the amount of AVC applied to an EF50 and the proportion suggested by the circuit, namely one-fifth, looks about right.

Coming to the plate circuit of the 2A6, the load resistor is unecessarily high and a value of 0.25 meg would be nearer the mark. That .05 mfd condenser for the tone control would certainly be drastic!

NOISE LIMITER

The noise limiter is the same type of circuit as evolved for our "Communications Nine" described in the February, 1947, issue. While it can be adjusted to cope with a wide range of signals, we have "given it away" in favor of a limiter operating in association with the detector.

This latter arrangement has been featured in most of our recent communications circuits. Its big advantage is that it adjusts itself automatically to carrier level and requires only an "on-off" switch. It is effective for interference exceeding about a 90% modulation level and in practice, does the same job more simply than the "Communications Nine" arrangement.

OTHER POINTS

Apart from a few component values which have been omitted, the rest of the circuit is in order. The total high tension current would amount to about 70 milliamps, under normal conditions, which means that the two back-bias resistors would, together, need to make up about 170 ohms. If we were describing a set, we would try to use 100 ohms in each position to simplify the parts list.

The B-plus bypass on the BFO coil would normally be 0.1 mfd.

Coming to the power supply, the first filter condenser would need to be watched, since the peak voltage during the warming up period could easily amount to 600 volts. A 600 PV electro might stand it, but a better scheme would be to use two 16 mfd, 525 PV condensers in series.

With 400 volts on the plates and a drain of 70 milliamps, the 5Y3 will deliver 435 volts to the filter, according to the curves. Assuming that there is to be no more than 260 on the high tension line, this leaves a margin of 175 volts to be taken up across the filter components. With 70 milliamps drain, the necessary filter resistance works out at 2500 ohms, which would be the approximate figure produced by 2000 ohm field and a typical filter choke.

The dissipation in the field would be 9.8 watts which is too much for anything but a 12" speaker.

For a smaller speaker, the field coil could be reduced to 1500 ohms, a heavy duty resistor being installed between the rectifier filament and the input to the filter to limit the HT voltage. A figure of about 300 ohms, 10 watts, would be our guess for this position.

Such then are our comments. If the reader in question makes the amendments suggested, and gets the tuning end working well, he should have a very nice receiver.

BATTERY SET

The second circuit is a much simpler type, submitted for comment by a reader in Adelaide.

He explains that he has a "IQ5-One" operating well, except for interference between a couple of strong stations. The feature of the present circuit is the addition of an RF stage.

We agree that the addition of the stage will improve selectivity a good deal, always providing that the tuned circuits track properly. No trimmers are shown on the diagram but it must be understood that these are necessary. One trimmer is connected across each section of the tuning gang and adjusted for maximum output at the high frequency end of the band.

The RF stage is quite in order, but there are two points of note concerning the detector. First of all, an RF bypass—about .00025 mfd—would be a good thing between earth and the junction of the RF choke and audio transformer. The capacitance in the windings of the transformer provide a certain bypassing effect, of course, but provision of a proper condenser at this point is a wise procedure.

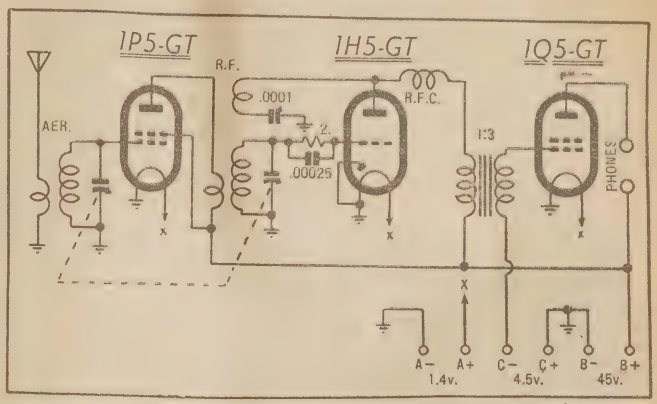
The second point is that the 1H5-GT is not an ideal valve to feed into an audio transformer, because of its high plate resistance. Unless the transformer has an unusual amount of primary inductance, the bass response will suffer considerably. Whether this is important or not with earphones is another matter.

In point of fact, the only 1.4 volt general-purpose triode, type 1G4-G, is not commonly available and of necessity, the 1H5-GT is usually pressed into service.

There is definitely too much bias on the 1Q5-GT since 4.5 volts is used only with a plate and screen voltage of 90. When the plate and screen voltage is reduced, the bias voltage should be cut down in the same proportion and a figure of 2.25 volts is indicated. Since the full power output will not be required to operate phones, it is reasonable to operate the 1Q5-GT in this case with bias of -3 volts.

The screen should, of course, be connected to B plus—an obvious slip in the drawing.

It's remarkable just how easy it is for such errors to occur. We know!



A much simpler battery circuit. Only a few points warranted criticism.

Plastics used to note stress

INSIDE views of stresses and strains in operating machinery are made possible by the temporary use of plastic counterparts long enough to make interior records for later study.

Stresses in a rotary shaft, nuts and bolts, crane hooks and other parts can be studied. To determine where a crane hook should be strongest, an exact model of the hook is made in plastic. This is heated to about the boiling point of water, and any block of the desired weight is hung on it. The hook, with the weight on it, is then allowed to cool to room temperature.

By this process the distortions due to the load are "frozen" in the translucent plastic hook.

Here's your answer, Tom!

We have just made the startling discovery that there are beginners in New Zealand. This month most of the questions originate from the far side of the Tasman, but it seems that Tom is Tom, the whole world over. In fact, we will be looking forward to receiving questions from even more distant climes.

What is the best way for me to get my "ticket"?

That is a pretty general sort of question, Tom, and you leave yourself very much at the mercy of our artist.

We saw a fellow get one only a few days ago and he wasn't the least

bit technical. All he did was to drive through the red lights!

Of course, anyone with a pennyworth of gumption would know that you are referring to the amateur operator's Certificate of Proficiency —so called in Australia—and known the world over as a "ham ticket."

We are not perfectly sure of all the details in New Zealand, but guess that the requirements are much the same as in Australia.

You must prove by examination that you have a good general knowledge of receivers and transmitters and that you are capable of operating a station in an intelligent fashion. This involves a fair amount of study, the best references being current radio magazines and books, like ARRL Handbook. You must also procure a copy of regulations governing the operation of amateur stations and be prepared to answer examination questions on them.

Last, but not least, you must demonstrate your ability to send and receive Morse code at somewhere about 14 words per minute.

By the time you get through all that and pass the examination successfully the only barrier between you and your ticket is a spot of correspondence and perhaps a fee to cover your station licence.

Can you add an RF stage in front of a crystal set and an audio stage behind it? If so, could it be run from a 9-volt battery?

You certainly could, Tom, and the thing should work quite nicely. Use a valve like the 1P5-GT for the RF amplifier, running the screen direct to B-plus nine volts and bypassing it to earth through a 0.1 mfd condenser. Use an ordinary aerial coil for the grid circuit and run the plate through a primary winding wound over or near the normal crystal coil.

In fact you could use reaction on the RF stage and pep things up quite a lot.

Regarding the audio stage, the best plan would be to obtain an audio transformer, connecting the primary in place of the earphones and the secondary between earth and the grid of a 1Q5-GT. With only nine volts on the plate and screen the 1Q5-GT would hardly need any bias. Provide 1.5 volts for the filaments and the set should go like a bomb—on earphones, anyway.

I have built some of your sets, including the "All-Band TRF." What would be the next one, remembering that funds are limited?

Well, Tom, if you have made a success of the "All-Band TRF" there would not be much point in staying around any longer with TRF circuits. The obvious step is to try your hand at a superhet.

The simplest receiver of this nature is the "2JU-Five" and we suggest you have a go at it. After that? Well, you are in the big set class and the expenditure of a certain amount of £ s d is inevitable unless you have managed to collect a few stray parts in the meantime.

What is the meaning of the letters SPST, SPDT and DPDT as applied to switches?

We must agree, Tom, that these letters look rather mysterious to the uninitiated, but their meaning is not hard to discover. Respectively, they stand for single-pole single-throw, single - pole double - throw and double-pole double-throw.

Taking the first one, the term "single-pole" means the same thing as "single-circuit." In other words, the switch is capable of controlling only one circuit or wire.

The term "single-throw" indicates that it operates in one direction only, and the switch therefore resolves itself into a simple off-on switch. In other words, when operated in one direction it closes a single circuit and breaks it when operated in the other direction.

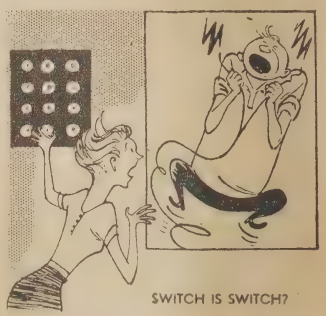
Your SPDT switch still operates on one circuit only (single-pole), but the "double throw" notation indicates that it has a double action. In other, words, when moved this way or that it switches one wire to either one of two other wires.

The DPDT switch has two poles —in other words, it is capable of controlling the destiny of two entirely different circuits or wires. Furthermore, being "double-throw," it can connect these two wires to either of two other pairs.

You have left out one set of initials, namely the DPST, indicating double-pole single-throw. A switch like this will simultaneously make or break two circuits.

The most common switch types are the ordinary toggle, the rotary snap switch, as used for power equipment, and the radio "wafer" switch.

By way of interest, the wafer switch in a dual-wave receiver may have to control from six to eight circuits with two or three switch positions. Such a switch can be defined as eight-pole two-way or eight-pole



SWITCH IS SWITCH?

three-way, as the case may be. Lazy people refer to them as eight by two or eight by three switches.

I noticed a receiver recently which had a fourth tapping on the volume control and a condenser wired back somewhere that I couldn't quite trace. What would this be?

We would say that the person who designed the set had a special flair for tone compensating circuits.

When the gain is turned down on a receiver the reduced volume gives an impression that both bass and

treble response have been impaired. The impression is purely an auditory effect, but attempts have been made to "rig" the circuit so that either the bass or the treble, or both, are increased in proportion as the volume is reduced.

One special way of gaining this effect is to run a negative feedback and tone compensating circuit into a fixed tapping on the volume control. Our tip is that the circuit in question employs some such device. We have not gone to such lengths in a Radio and Hobbies circuit, so that we cannot refer you to a particular issue.

I am keen to build a midget super regenerative set for portable work. Can you give me any hints to get the best gain and selectivity?

Well, Tom, super regenerative sets are notorious for their lack of selectivity and we doubt whether much can be done to improve them, apart from adding an RF stage or using a very short aerial.

What is more to the point, they tend to radiate badly and may cause severe interference in neighboring receivers. For this reason they are not very popular, even among amateurs, except at very high frequencies. On the broadcast band they can be a menace!

Can more than three coils be used in a crystal set, and would it be necessary to have more than two tuning condensers?

The normal limit, Tom, is two tuned circuits, requiring two coils and two condensers. The third coil would be one to couple the aerial or, alternatively, the crystal circuit. We doubt whether any more than this would be practicable, since the additional selectivity you might gain would be offset by too drastic a reduction in volume.

Quite frankly, we have never tried to use more than two tuned circuits but hardly think it worth while. You can be sure, however, that a third tuned circuit would necessitate the use of three tuning condensers in all

Could a two-gang condenser with or without a trimmer be used in a crystal set, and would it affect the value of the fixed condenser?

The idea would be to use one section of the condenser only, and it would take the place of an ordinary single gang. The value of other components in the circuit would not be affected.

If a circuit specifies H-type tuning condensers could any other be used?

There is nothing special or mysterious about the H-type tuning gang apart from the fact that it is a standard and a very good one.

However, as far as tuning is concerned, any other gang can be substituted which has a similar capacitance range. Some gangs have a slightly higher minimum value and a slightly lower maximum value, and this affects the frequency coverage to some extent at the extremes of the range.

There is one other point, Tom, in that the "law" of the various gangs is different. In other words, the plates are so shaped that the capacitance change with rotation is slightly different. This affects the distribution of stations on the dial, so that the glass calibrated for one gang may not "track" with another. Thus, when a particular dial is to be used it is important to obtain the right condenser—or vice versa.

The business of tracking, however, is more likely to concern the big set enthusiast than someone in the crystal set stage.

A receiver to operate from 32 volts

(Continued from Page 29)

so that the grid pin is closest to the aerial coil connection.

There is an important wiring point here. Run the lead from the gang to the aerial coil across the top of the chassis rather than underneath. Otherwise, there is a possibility of instability, due to its capacity to the plate lead.

The R.F. and oscillator coils are mounted alongside their respective gang sections. The R.F. coil is nearest the 6BA6 and the oscillator coil towards the rear of the chassis. From the R.F. coil, the layout follows an unbroken line around the edge of the chassis to the output valves, which are mounted at the back on the extreme right hand side. The filter choke is mounted on the right hand side of the chassis in front of the output valves.

Still looking at the chassis from on top, the volume control is on the left, the tuning control in the centre and the tone control on the right.

As we have emphasised, the wiring underneath the chassis is particularly simple. Endeavor to keep the unimportant leads in a cable running around the edge of the set. When the wiring is complete they can be bound neatly together with a length of dial cord, or similar. This applies to AVC leads but not to grid and plate leads. The latter should be run by the most direct route. There are several small components, involved in the detector and AVC circuit, near the final I.F. transformer. It is a good idea to install a small tag strip to support these.

One or two tag strips are desirable at the audio end also to support the small components.

Incidentally, none of the condensers need have a higher rating than 200 volts and ½ watt resistors may be used in all but two instances.

In our experimental set, the bias battery is of the type used for cycle lamps. It is supported underneath the chassis by a bracket made from scrap aluminium. Since there is no current drawn from the battery, it will last its shelf life. If you happen to have a pair of torch cells on hand, they can be used. Wire them in series and make up a supporting bracket to suit from scrap aluminium.

(Continued on Page 95)

But STILL the best RADIO PARTS SUPPLIERS in this country. We supply ANYTHING and EVERYTHING in the Electronic field. Let us know what YOU NEED. LOW PRICES, PROMPT same DAY SERVICE — KIT-SETS, AMPLIFIERS, COM-RECEIVERS, T'MITTERS, built to order, or serviced. Write for Quote.

TOM THUMB BATTERY RECEIVER

This two valve midget radio is the smallest self-contained battery radio in Australia.

Range: 200-300 miles. Plays anywhere. Weight: 3lb. Measures 4½ x 5 x 3 inches.

Using the latest type midget valves in a special low drain battery circuit, this receiver comes ready to operate in a beautiful leatherette cabinet. It is the ideal receiver for:

- Boy Scouts.
- Hikers.
- Campers.

£8/17/6 (post extra).

- Home or office.

"LATEST TYPE MIDGET VALVES"

6X4 Midget Rectifier	14 9
6BE6 Midget Converter	19 6
6BA6 Midget RF Penthode	19 6
6AU6 Midget Midget RF Penthode	19 6
6AQ5 Midget Output	19 10
6J6 Midget UHF Twin Triode ..	17 6
6C4 Midget UHF Triode	7 6
9004/6 Midget Diode UHF	6 0

(Post extra)

We carry all types. Write for quote.

CARRY-SET AC Power Supply Kit, complete with all parts. 93/6.

150/150v 30ma transfrms.	18 6
4 valve Miniminor chassis	4 0
4 valve Miniminor chassis	5 6
Metal chrome Inst. probes	10 3
Type 6G6 valves (octal)	10 0

(Post extra)

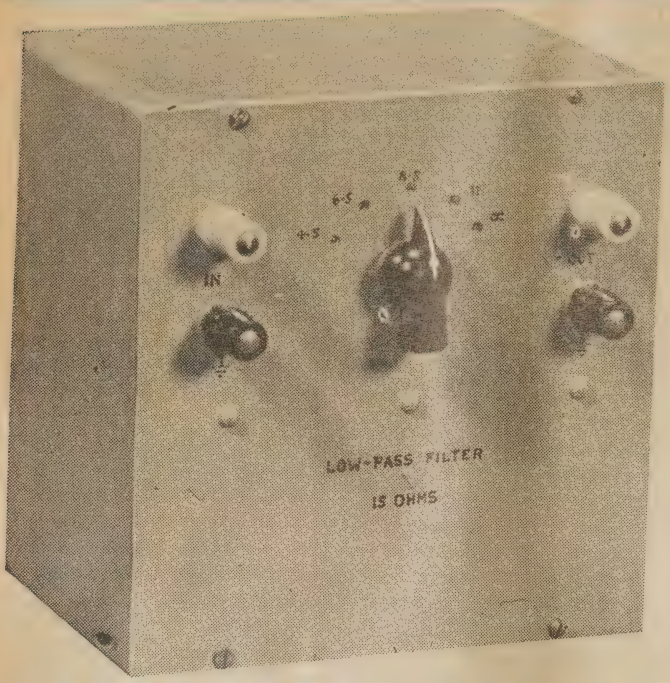
For EVERYTHING in RADIO

F.N. RADIO-TELEVISION CO.

265 MILITARY ROAD, CREMORNE, SYDNEY.

Phone: XM7063.

"Same Day Mail Order Service"



Here is the filter unit built into a small cabinet. Shielding is not particulary important although it should not be mounted close to the power transformer.

VOICE COIL TOP CUT FILTER

In some ways, the installation of a high fidelity speaker is the most significant single step in the progress towards better reproduction. It is certainly the one which is most likely to be attended by disappointing results. This article examines the conditions which apply today and answers many of the questions which have been put to us recently by our readers.

by W. N. Williams

TO begin at the beginning, a true high fidelity speaker has four special advantages to offer:—

(1) Smoother response curve and fewer cone "tweets."

(2) Reduced intermodulation distortion.

(3) Extended base response.

(4) Extended treble response.

The effect of (1) and (2) is immediate and obvious. Orchestral music in particular has a more open texture. Instruments are more cleanly defined, and there is less tendency for complex passages to dissolve into jumble of sound. Voices stand out better from the accompaniment and so on.

All this goes automatically on the profit side of the ledger and, to the discerning listener, these qualities alone could easily justify the higher price. Unfortunately, however, the ramifications of wider frequency response often confuse the issue, and, unless understood, may lead the enthusiast to wonder whether, after all, the expense was justified.

BASS RESPONSE

Consider first the matter of bass response. Ordinary 12-inch loudspeakers are mass produced items, intended for use in open backed radio consoles. A cabinet is not a particularly effective form of baffle and, to simulate good bass response, it is convenient and conventional to give the speaker a fairly obvious cone resonance at about 70 c/s.

The net result is acceptable to most listeners but, in actual fact, the combination of speaker and cabinet characteristics often combine to give the bass a single-frequency "thumping" quality, which is a far cry from the original. Considerable improvement can be effected by proper baffling methods, but a prominent resonance in the 70 c/s region still sets a limit on the ultimate result.

CONE RESONANCE

In a high fidelity speaker, the cone resonance is normally lowered to at least 50 c/s — some get down to 20 odd cycles—and every effort is made to limit the natural rise in output. When properly baffled, a good speaker can produce more or less even output down to the 30-cycle region. The thumping bass gives way to a smooth throb with a varying and distinctive pitch.

Good acoustic output at these very low frequencies calls for considerable cone movement and the magnet structure must be of ample dimensions if the voice coil is always to remain in the region of flux. This is a basic reason why all high fidelity and bass speakers use a magnet structure of generous dimensions. However, we are digressing!

When a high fidelity speaker is mounted in an open-backed cabinet, there is, therefore, no obvious cone resonance to reinforce the output where the baffling becomes poor, and it is easy to gain the impression that the bass response of the expensive speaker is bad. The fact that it may be distinctive and smooth is not always appreciated.

In other words, a high fidelity speaker is not intended to compensate for the limitations of a poor baffle. It should be provided with a vented enclosure or some such arrangement suited to its characteristics to allow it to produce the even bass of which it is capable. This is —and will remain—the correct and fundamental treatment.

BASS BOOST

However, for ordinary domestic listening, where the power capabilities of the speaker are not likely to be tested, a good substitute can be found in the discreet use of bass

boost. Provided the cabinet is of ample dimensions, and heavily built, excellent results can be realised in this way and certainly far better than from a conventional speaker with a higher cone resonance.

In practice, for ordinary domestic listening, a rise of about 3db. per octave is adequate, effective below 250 c/s. This must be additional, of course, to any boost which may be required to compensate the pickup. (The requisite boost is available immediately from the R & H "Universal Tone Control" (Feb., 1949), with the facility of being able to switch it out at higher operating levels).

So much for the bass end. The treble register, however, is the one which provides the real headaches for the would-be quality enthusiast.

HIGH RESPONSE

Ordinary loudspeakers are fairly effective up to about 5 kc., beyond which the response tapers steeply. Even though it may be possible to reproduce higher frequencies by stepping up the input power, the upper frequency components under normal listening conditions do not have any great bearing on the ultimate quality of the sound.

The listener is largely unaware of components, good, bad or indifferent, above 7 or 8 kc., and even there only to a limited extent.

By way of contrast, some wide-range speakers show no diminution of output in this region at all, and have a substantially level response up to the limits of hearing. For the first time, perhaps, the listener hears components in this upper register and not all of them make for pleasant listening. First impulse is to blame the unpleasant effects on the speaker, seeing its introduction has made them evident. This is immediately disproved, however, by the fact that not all recordings and programmes are so affected.

A common experience is for studio programmes, via FM or wide-band AM to be extremely good, but for recordings to show varying degrees of distortion. In fact, the majority of records in a typical collection are likely to be unplayable. The usual effect on the listener is one of complete bewilderment. Even the traditional tone control does not seem to help much.

HARMONICS

The answer is bound up very largely in the reproduction of high order harmonics, present in the signal source or generated by the record-pickup combination. Recent articles have shown the number of variables which do occur to compromise the ultimate result.

In brief, discontinuities in the overall reproducing chain produce a substantial proportion of noise, intermodulation products and harmonic distortion. The components which have the most damaging effects on reproduction are concentrated in the upper register, above 5 or 6 kc., and these are the very components which are revealed by the use of a high fidelity speaker system.

Radio stations have the same difficulties with recorded programmes, although many of them eliminate the doubtful part of the range by using a selective low-pass filter. But, in addition, they have their own worries with lines and amplifiers, &c. Listeners who operate wide-band tuners are well aware of the variation in programme quality, even when feeding a more or less conventional speaker system.

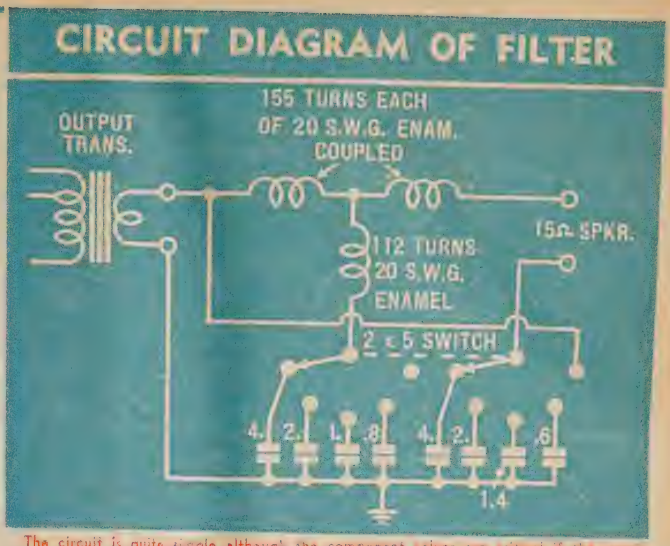
As the treble register of the equipment is expanded, and particularly of the speaker, it becomes increasingly important to minimise harmonic distortion and intermodulation effects. Distortion figures, which are tolerable with a limited range may easily be sufficient to render an item completely unbearable when the response is extended to 15 odd kc.

High order harmonics and intermodulation products are generally dissonant and sound exactly like a mechanical fault in the loudspeaker —a loose voice coil turn or such like. The effect increases with the high frequency responses of the system and is further exaggerated by any response peaks which may be present.

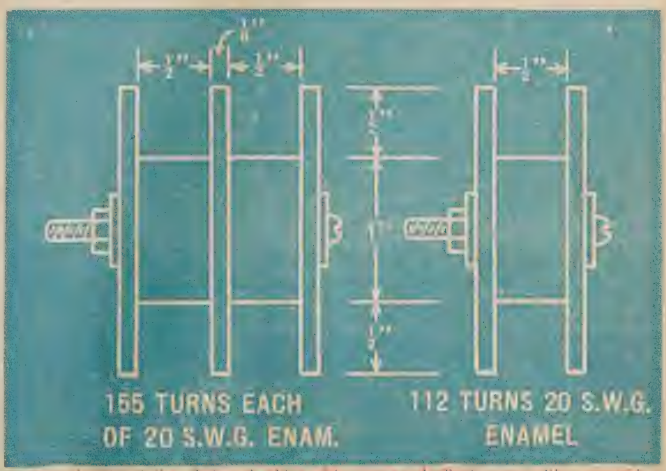
SPEAKER CURVE

The accompanying curve shows the response of a twin-cone Goodman's Axiom 12, taken on equipment which was calibrated only from 50 to 12000 c/s.

The speaker was mounted for test on a 4ft square baffle, and the effect



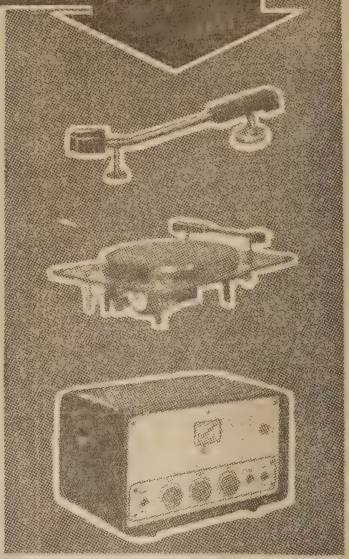
The circuit is quite simple although the component values are critical if the exact cut-off characteristics are to be maintained.



These details of the chokes should enable you to duplicate ours with reasonable accuracy.

MAGRATHS HAVE THEM!

In addition to the popular Connoisseur products listed below, new pick-ups and turntables specially designed for use with the latest micro-groove long-playing records are on the way.
Amongst these is a two-speed turntable giving speeds of 33 1-3 and 78 r.p.m. Full 12" in diameter, lathe-turned and manufactured in non-ferrous material. The main spindle, precision-ground and lapped, runs in phosphor-bronze bearings, and is virtually vibrationless. High-grade studio microphones and recording equipment.
All Connoisseur products are precision-built and individually tested.



Connoisseur *(Reg'd)* **PICK-UP . . .**

An acknowledged leader in its class, giving an even response curve from 30-1200 C.P.S. Only 30 grams is required at needle point for correct tracking. 2 models are available; standard (illustrated) for 10"-12" discs and transcription arm model for playing 17" discs.

Connoisseur *(Reg'd)* **GRAMO-MOTOR**

Is designed for the connoisseur who likes these fine technical developments that produce faithful reproduction. The heavy non-ferrous turntable is machined to run dead true, the flywheel action eliminating all "Wow."

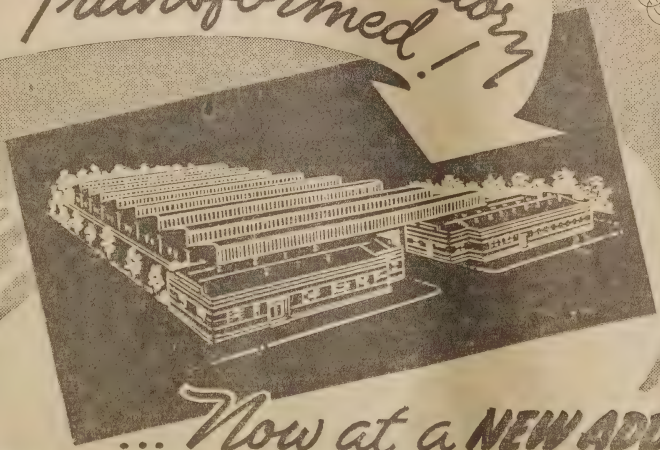
Connoisseur *(Reg'd)* **AMPLIFIER**

Is in the true tradition of Connoisseur sound reproducing instruments. Distortion at 5W is less than 0.5 per cent. Bass control variable from 3 to plus 15 db at 50C.S. Treble control variable from minus 20 to plus 8 db at 15kcs.

J.H. MAGRATH & Co.

208 LT. LONSDALE ST., MELBOURNE *Phones:* CENT. 3688 4414

Even the **TRIMAX** *factory is Transformed!!*



... Now at a **NEW ADDRESS**

CHARLES ST., NTH. COBURG MELB. AUST.

of the limited baffling is apparent from the way the response tapers below about 220 c/s. It is readily apparent also, that the response could be compensated, at low levels, anyway, by applying a small amount of bass boost as already suggested. There is no serious bass resonance within the calibrated range to complicate this procedure.

In the treble register, a narrow peak at 7 kc, is likely to emphasise scratch and distortion in this region, but, beyond that, the response is substantially level to 10.5 kc. Then there is a dip and the output is rising again at 12 kc. Listening tests beyond this point suggest that the rise continues, and plenty of output is obtained up to at least 15 kc., where most ears cease to function.

CURVES

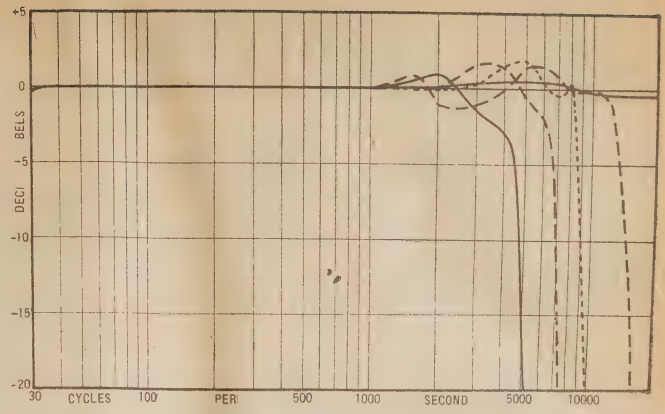
The difference between this and a conventional speaker curve will be immediately apparent, and it is not difficult to appreciate how readily spurious frequency components can entirely alter the character of the sound.

Various other speakers, boasting extended treble range have response curves intermediate between the Axiom series and a conventional speaker and their sensitivity to distortion content is likewise in the "in-between" region.

The problem which therefore faces the quality enthusiast is fairly obvious. If a high fidelity speaker is only useful on distortion-free programmes, is the outlay worthwhile at this stage? Or, having already purchased such a speaker, how can its response be modified to make it even usable on mediocre records and programmes?

The obvious requirement is a means for limiting the treble response of the system, where distortion and noise in the upper register make it necessary to do so.

Faced with this very problem, we made careful listening tests, using ordinary top-cut tone controls, but found them to be entirely inadequate for the purpose.



This curve shows the frequency characteristics of our filter for the various cut-off positions.

Some programmes or records demand a large amount of attentuation beyond 5 or 6 kc, and, by the time it is attained with an ordinary tone control, frequencies well below this limit have suffered severely. The overall effect is often less acceptable than with a conventional speaker and no top cut.

The answer to the whole problem of distortion, record noise and heterodyne beats between stations, lies in the use of a selective low pass filter. Such a unit allows the system to operate without loss over the "clean" portion of the spectrum, eliminating everything else.

DESIGN

The requirements were examined in our last issue, and a unit evolved which could be connected into the programme channel of any standard amplifier. Using a general purpose triode, the unit gave a stage gain of two, and used components which could readily be obtained. The chief objection to the scheme is the need for establishing a power connection to the main amplifier, and of dealing with any hum or instability which may result.

What are the chances, then, of connecting a suitable filter into the voice coil circuit of the speaker and obviating these difficulties at one stroke? Would the varying terminal impedances render the scheme unworkable or upset the amplifier characteristics?

Fortunately, most amplifiers these days use triode valves or pentodes with feedback and have a fairly low and constant output impedance. The voice coil impedance is subject to wider variations, but perhaps not enough to render the scheme impracticable. Accordingly we worked out a set of constants for a 15 ohm

A rear view of the unit taken out of the cabinet..

GET "SPOTLESS" RECEPTION in 1950

LINE FILTER TYPE LF20 .. .. Price 27/-

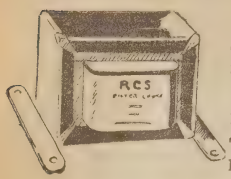
Specially designed and constructed to eliminate all noises which occur by reason of feedback from power mains—electric motors—refrigerators—elevators—sub-stations—high tension wires—irons. Easy to instal, it connects between the radio and power point.

DUAL WAVE UNITS

Type DW29 4/5 Broadcast and short wave .. .. .. 34/- ea.

Type DW37 5/6 with RF stage .. .. £6/10/- ea.

AUDIO TRANSFORMERS



Size 2¾" x 2 3-8" x 1¾".

Type TB42. A Class single 3 to 1 ratio .. .. 21/- ea.

Type TB43. A Class push pull 3 to 1 ratio .. 22/6 ea.

Type TB44. B Class push pull 1½ to 1 ratio, 21/- ea.

DA7 DIAL .. .. Price, 11/- ea.

This portable D/W Kit Dial has all parts supplied ready to assemble and has a glass scale with B/C and S/W bands clearly marked, finished in white with green background. The special walnut escutcheon is easy to fit and requires an aperture of 3" by 3". This dial can be edge-lit.

Standard Intermediate Transformers

Round Can Size, 2¾" x 1 3-8". 455—K.C.

Type IF170, 1st stage Permatune Iron Core 13/-

Type IF171, 2nd stage Permatune Iron Core 13/-

Type IF172, 1st stage Permatune Iron Core 13/-

Type IF173, 2nd stage Permatune Iron Core 13/-

Type IF174, Low gain Permatune Iron Core 13/-

175—K.C. Square Can Size 3" x 1 3-8".

Type IE74, 1st stage Permatune Iron Core 13/9

Type IE75, 2nd stage Permatune Iron Core 13/9

R.C.S. RADIO

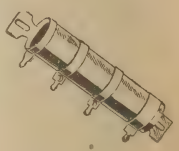
FOR 30 YEARS — THE NATION'S BEST COMPONENTS

POTENTIOMETERS AND RHEOSTATS

The volume control is constructed to cut off all volume. The main fillings are made from high grade nickel silver, and they are so manufactured to be completely noiseless.

PT40	6 ohm	1/4 amp ...	7/6
PT38	10 „	1/4 „ ...	7/6
PT39	20 „	1/4 „ ...	7/6
PT34	30 „	1/4 „ ...	7/6
PT46	400 „	50 MA	7/6
PT47	1000 „	35 „	7/6
PT49	2500 „	30 „	7/6
PT51	5000 „	30 „	7/6
PT52	10000 „	20 „	7/6

VOLTAGE DIVIDERS



Wound with oxidised nichrome wire on round bakelite formers, 3⅜" x ¾", complete with mounting legs.

VD25 15,000 ohm — 2 variable clip 5/6

VD25 25,000 ohm — 2 variable clip 5/6

BROADCAST COILS Round can, 2" by 1 3-8"

Type E256 Aerial Coils 7/6

„ E357 R F Coil 7/6

„ E358 Osc. Coil 7/6

T.R.F. Coils. Square Cans 2 3-8" x 1 3-8".

Type T81 Reinartz Coil 5/6

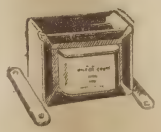
„ T82 Reinartz Coil 6/6

„ T87 R F with Reaction Coil 8/6

„ T88 Aerial Coil 8/6

„ T89 R F Coil 8/6

FILAMENT AND AUTO TRANSFORMERS



Type TP55, 6.3 volts, 3 amp., 15 watts .. .. 14/6 ea.

Type TP80, 6.3 volts, 4 volt and 2.5 volt tappings .. .. 11/6 ea.

R.C.S. RADIO PTY. LTD., 174 CANTERBURY RD., CANTERBURY, N.S.W.

voice coil circuit and using the same type of network as described last month.

A unit was built up accordingly and given a test run, using a speaker load and a push-pull tetrode amplifier with moderate feedback—about 10 or 12 db. Slight changes had to be made in some of the constants, apparently to compensate for the reactive terminations, but no special difficulties were encountered.

The curves may appear rather bumpy at first glance, but the decibel scale is quite open and the actual deviations from the 1000-cycle reference do not exceed about 2 db. up to the "roll-off" frequency. They would certainly not be audible under listening conditions.

It is necessary to remember also that the curves reflect the characteristics of the whole amplifier from the input terminals to the voltage actually present across the voice coil. The only liberty taken in drawing the curves has been to ignore the slight jaggedness which characterises the curve of any speaker. It has no material bearing on the results.

LISTENING TESTS

On listening tests, the unit is just as effective as the one described last month and provides the complete solution to the problem of using a high fidelity speaker. One switch position cuts the unit right out of circuit, while other positions give progressively lower cut-off frequencies and allow even bad discs to be played without discomfort.

Using a wide range pickup, each step is as obvious as the next in its effect on noise and distortion, even the step between 13 Kc. and "infinity." With pickups, amplifiers or speakers having more limited range, the upper steps are less obvious in their effect.

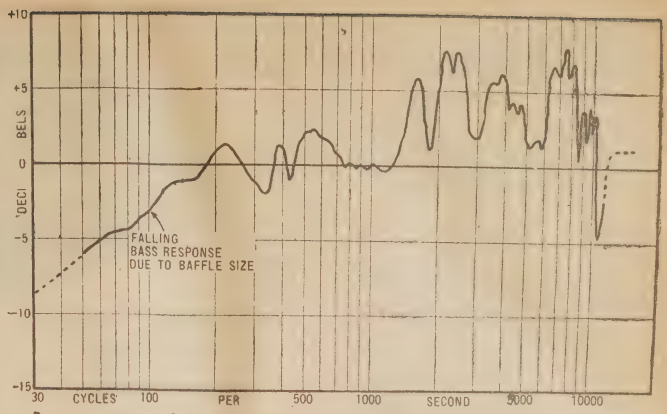
Coming to the actual component values, the chokes are wound with heavy gauge wire on the same size bobbins as specified last month. Their inductance has been reduced to approximately one-hundredth of the original value and the condenser values multiplied by approximately the same factor. However, we have deliberately "juggled" the constants to permit the use of convenient condenser values in most of the switch positions.

RESONANCE

The condensers selected by the left-hand switch section resonate the trap circuit and determine the frequency of maximum attenuation. On their own, however, they produce a relatively slow roll-off on the low frequency side.

The condensers on the output side of the filter should resonate at a slightly lower frequency. They sharpen the knee of the curve and prevent the tendency for the output to rise again in the upper register.

Nominal values are given for the condensers, but the actual bridged values, reading from left to right, were as follows: 4.0, 2.0, 1.04, 0.86, 4.3, 2.0, 1.4, 0.6 mfd. The values are reasonably critical, and some effort is justified to get them near the mark.



Response curve of a twin-cone Goodman's speaker, mounted on a 4' square baffle. Or a large baffle, response is substantially level to 45 c/s. Output is high in the 7-11Kc. region and, on listening tests, well sustained up to at least 15 Kc.

In the course of building the unit, we bridged quite a few condensers, both very old and very new. Generally speaking, old block condensers from the pre-electrolytic era were unsatisfactory. Some had developed a high degree of leakage and most of them varied anything up to 50 per cent from the marked value. It is wise to avoid such condensers, unless a means of checking is available.

On the other hand, most of the condensers of more recent manufacture, or salvaged from disposals gear, were quite close to the mark and could be used directly. If you have an audio generator available, and can measure the audio volts across the voice coil, so much the better. The condenser values can be juggled to give results equal to or better than those indicated by our curves.

The remaining big question is what to do about speakers having lower values of voice coil impedance.

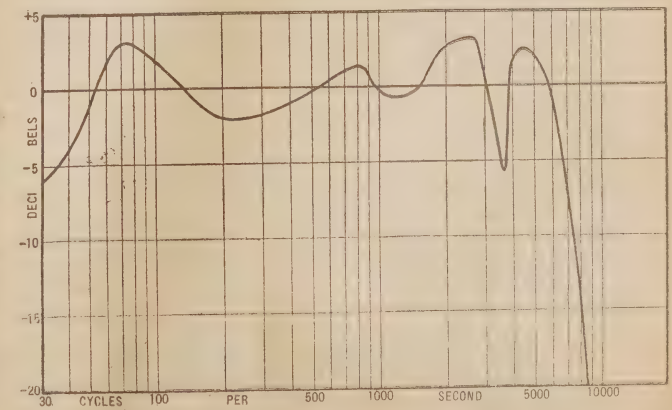
As explained in the earlier article, there is an optimum L/C relationship for every impedance value of the circuit into which a filter is connected. For this very reason, it was essential to apply the correcting factor of 100 to the constants employed in last month's circuit.

LOW IMPEDANCE CIRCUIT

If this new filter is connected into a voice coil circuit of too low an impedance, the curves will tend to develop a trough about half-way along, then rise to a substantial peak just below the cut-off frequency. The cut-off itself is likely to shift also, so that the net result is not a very happy one.

On listening tests, the results are confusing, since the incidence of a peak in a particular position may give the impression that the response has been extended when the reverse may actually be true. This is particularly likely to occur when

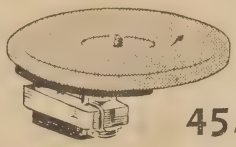
(Continued on Page 73)



Response curve for a typical Australian-made single-cone 12" speaker. Based on fewer readings, it omits details of minor peaks and troughs but indicates the general configuration. The baffle, in this case, was of more adequate dimensions. Note 75-cycle cone resonance.

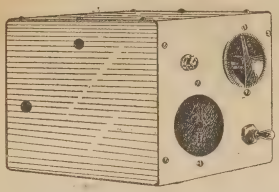
For Everything in radio . .

SEE MAXWELLS



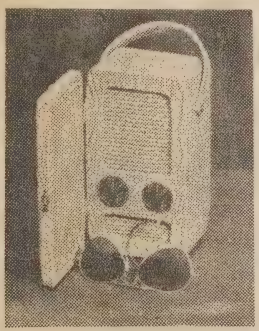
45/-

GRAMMO MOTORS
Well known ENGLISH make
220/250 Volts
Complete with turntable. 45/-



AUTOPAK by JEWEL

Converts your A/C Radio to a CAR RADIO or Vibrator Set. This unit fits neatly into your car and is easy to connect to your set. The Power Cord may be as long as desired, which means you can operate your set well away from your car **£9/10/-**



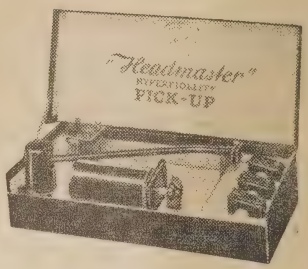
CARRY SET
Personal Portable Kit

CARRY SET 4 Valve Personal Portable as featured in Radio & Hobbies October issue. Easy to construct and splendid performer. Complete in every detail, including batteries **£10/10/-**
Cabinets only 32/6
Chassis (complete with bracket) 10/6

Goldring Quality Products

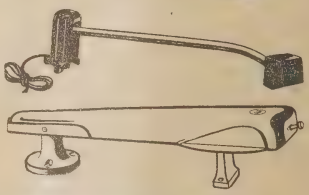
HYPERFIDELITY PICKUPS

HEADMASTER, complete with 3 cartridges, Tonaliser and Transformer	£10 14 6
Replacement Cartridge	1 8 6
Tonaliser only	2 16 0
Transformer only	2 6 9
16in Arm only	1 19 6



LIGHTWEIGHT PICKUPS

121 with Sapphire	3 13 10
121 without Sapphire	3 1 8
122 (Bronze) with Sapphire	3 13 10
122 (Bronze) without Sapphire	3 1 9
123 (Cartridge type) with Sapphire	3 13 10
125 for Standard Needles	2 17 0



STANDARD PICKUPS

100	2 5 6
100/Ivory	2 9 6

BANTAM PICKUPS

("Almost" Lightweight) 130	£2 1 2
Replacement Heads for all Garrard Record Changers from RC4 to to RC70 G.1 with Miniature Sapphire (Lightweight)	2 15 9
G.2 for Standard Needles	2 5 3

PICKUP HEADS

Convert your Portable Gramophone into a Record Player simply by connecting it to your wireless

112	£1 13 4
112/Ivory	£1 15 1

JANUARY BARGAINS — *Every Item Listed — Less Than* ½ *Price*

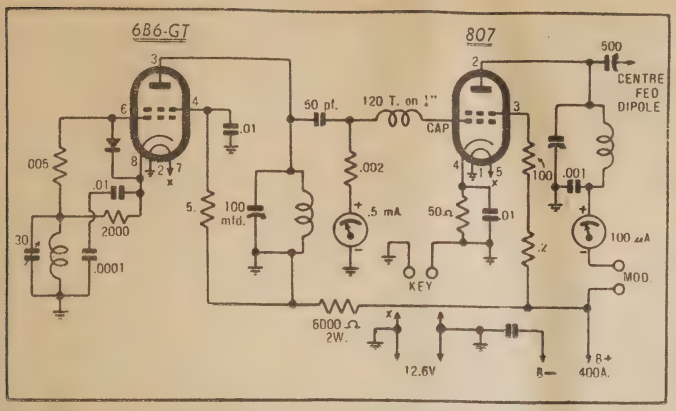
1. 3 Gang "H" Midget CONDENSERS, 3½ x 2¼ x 1½ 12/6
2. B & E Effco DIALS, N.S.W. Markings, 6 x 2¾, Edge Lit 7/11
3. Little General Cabinets 9/11
4. ETHERTONE PICK-UPS, BRAND NEW . 21/-
5. H.M.V. PICK-UPS 37/6
6. 5 Valve Chassis Standard Cut-Out, 11¼ x 7¼ x 3 . . . . . 3/6
7. Midget Speaker Transformers, all sizes .. 7/6
8. Ferrotune KINGSLEY 4 VALVE Units .. 27/6
9. P-C 54 Crown Iron Core R.F. Coils 2/3

MAXWELL'S RADIO

48 ELIZABETH ST., MELBOURNE. CENT. 4913

Add Postage to all amounts—Same Day Despatch

HOW MANY ERRORS ARE THERE?



At the recent Field Day held by the NSW Division of the WIA, a circuit containing a number of errors was the subject of a competition. The idea was to find the errors, and what a list was compiled by some earnest people! One return listed 50 errors, which was about twice the number orginally included! Just to make matters interesting, here is the circuit and our list of mistakes. What is your score?

OFFICIALLY there were 25 mistakes in this two-valve circuit, so you can set about now to find them. After you have done your best, check your notes against the following list.

1. The first valve should obviously be a 6V6-GT. There is no such valve as the 6B6-GT and the 6B6-G anyway is not a tetrode.

2. The crystal symbol is for a detector, not a quartz crystal.

3. The grid resistor should be .05 meg. The value of .005 is most unlikely.

4. There should be a junction, not a crossover between the .01 mfd cathode bypass and the resistor.

5. A bias resistor of 2000 ohms is most unlikely. 200 ohms is the usual value.

6. Screen resistor would not be 5.0 meg. Normal value is 0.5 meg.

7. The valve pin numbering is wrong. Grid should be pin 5.

8. Plate tank condenser should read 100 pf, not 100 uf.

9. Last, but not least, the 5000 ohm dropping resistor would need to be rated at 5 watts. 2 watts is much too low a figure.

10. The blocking condenser is omitted anyway from the plate coil, effectively shorting B plus.

So much then for the first valve. Coming to the second stage, which incidentally carries the right type number, we find the remaining 15 errors.

11. The 807 grid leak should be .02 meg. not .002 meg.

12. The meter reading should be 5mA, not 0.5 mA.

13. The meter is shown the wrong way around in the circuit.

14. The 807 grid choke has far too many turns, 12 being the more usual figure. That is, of course, unless the rig is intended for "pirating" on the broadcast band.

15. The screen bypass is missing.

16. The series screen resistor should be .02 meg. not 0.2 meg.

17. Connections to the plate current meter are the wrong way around.

18. Meter range should be 100 mA, not 100 uA.

19. The 807 screen is supplied from the wrong side of the modulating source.

20. B plus voltage is wrongly labelled "400A." Quite a power supply!

21. B- goes to earth through a condenser. One case where a broken down condenser would be a good thing.

22. The key is permanently shorted out.

23. Supply to the heaters is marked 12.6 instead of 6.3.

24. Both sides of the heater supply are shown earthed. This is not usual!

25. If you have a dipole aerial, you don't feed it that way.

That was intended to be the end of the story—but it wasn't. We planned to make the pin numbers right on the 807 socket, just for a change. Unfortunately our draughtsman made an error and we didn't notice it! So there are 26 mistakes!

CARS are hill-tested on level ground at a British automobile proving ground in Warwickshire, England. To achieve the trick, the manufacturers devised a power-absorbing trailer which is attached to the car being tested. Drag produced by the power-sapping machinery makes it possible to determine hill-climbing performance.

The transparent tape that seals without moistening

There are dozens of little jobs that crystal-clear, firm holding "Durex" tape does every day. Look for it in the plaid dispenser that's so practical and economical.

300 INS. ¾-INS. TAPE 2/6
150 INS. ½-INS. TAPE 1/3

The Heavy-Duty Dispenser for shop and factory. For use with 2592 in. rolls of "Durex" Tape. 15/- plus tax

The smart Desk Dispenser for home or office. For use with 1296 in. rolls of "Durex" Tape. 12/- incl. tax

TRADE MARK
DUREX
BRAND
Cellulose
TAPE
AUSTRALIAN DUREX PRODUCTS PTY. LTD., LIDCOMBE, N.S.W.
D9/A9

RANGE INCLUDES

I.F. TRANSFORMERS (Standard and Miniature).

COILS — BROADCAST (Standard and Miniature.)

COILS—SHORT WAVE (Standard and Miniature.)

COILS—DUAL WAVE (Standard and Miniature.)

Tuning Units, etc.

☆ ☆ ☆

IMPORTANT!
If your usual supplier is unable to supply your requirements of "VEGA" Products, drop us a line mentioning his name and address.

CRANCH PRODUCTS & TRADING CO.
17 BOND STREET, SYDNEY
Phones: BU3879, BW7746
Telegrams: "CRANLAY" Sydney.
Associated with
TELECOMPONENTS PTY. LTD.

---------- MAIL THIS TODAY----------

Please place my name on your mailing list for free issues of "Vega" Technical and Data Sheets.

NAME .....

ADDRESS .....

..... 12 R/H.

FIVE VALVE CHASSIS 30/-

These are trade-in sets removed from their cabinets. They have transformer, gang, coils, dial, sockets, resistors and condensers and are an absolute gift at 30/- each.

We can also supply these chassis with all valves and eight-inch speaker guaranteed in working order for 95/-.

Packed and railed to your nearest station f.o.r, Sydney.

THE RADIO MART

439 PITT STREET SYDNEY. Tel. MA2351

WHY DO PHONE CORDS TWIST?

The latest twist in telephone cords is a substance called neoprene. This was learned from an official of the New York Telephone Company during a discussion concerning the tendency of some telephone cords to take on the appearance of a series of gordian knots.

A QUICK survey had indicated that three of every ten telephone cords looked as if a class of novice seamen had been practising plain and fancy splices.

USE OF NEOPRENE

The telephone company denied that its cords had an innate tendency to curl into exotic designs. But, at the same time, it was said, neoprene is a synthetic rubber that will virtually do away with the tendency to knot as do old-style cords. Neoprene is non-kinkable, longer-wearing, and is currently being used in 60 per cent of installations.

As to why the present cords entwine themselves in an entente cordiale, the telephone company was about as helpful as a wrong number.

Observation of phone-users indicated that maybe the crux of the crookedness lay in a twist of the wrist. The position of the receiver on French-type hand-set, for example, is with the openings on the "down side." But frequently when persons lift off the receiver they do so with the right hand and turn the openings 180 degrees to the "up side." Then, in transferring the receiver from right to left hand, they complete the remaining 180 degrees of the circle, going in the same direction.

WHICH HAND?

The result is an unnatural convolution of the cord. An analagous 360-degree circular motion is sometimes gone through even when the left hand exclusively is used. In this case, there is an interruption, or several, and when the receiver is picked up again it is picked up with a 180-degree turn on the horizontal plane, from east to west, as it were.

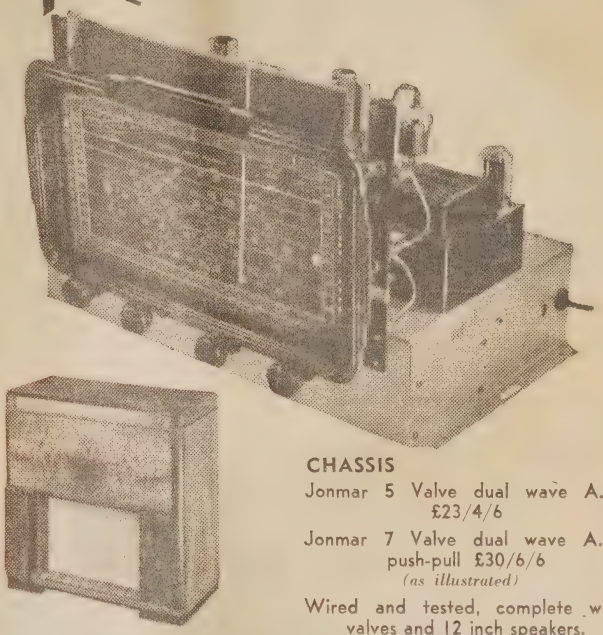
This is disastrous to the symmetry of the cord. Often a delayed-action twist will ruin an otherwise perfect handling of the phone. This occurs when the receiver is being placed back, and again consists of a 180-degree horizontal plane turn, often done as an unconscious flair of an artistic nature. It sure puts a kink in things.

TO keep a camera cable release operating smoothly and with a minimum of pressure, lubricate it frequently with graphite. Unscrew the button end from the sheath, remove the cable, and rub it with a pencil lead or powdered graphite. Never use oil to lubricate the cable.

For your NEW YEAR Radiogram

JOHN MARTIN PTY. LTD.

present the latest in QUALITY PRODUCTS



CHASSIS

Jonmar 5 Valve dual wave A.C. £23/4/6

Jonmar 7 Valve dual wave A.C. push-pull £30/6/6
(as illustrated)

Wired and tested, complete with valves and 12 inch speakers.

CABINETS

Jonmar radiogram (drawer type)	£15 15 0
Jonmar radiogram standard	£21 10 0
Jonmar 2-door de luxe radiogram (as illustrated)	£29 10 0

PICKUPS

Connoisseur high fidelity	£6 4 8
Tecnico FP8 permanent Sapphire	£6 9 0
Tecnico FL48 crystal	£5 4 0
Acos GP6 magnetic	£2 4 1
Acos GP10 crystal	£2 8 6
Acos GP12 crystal (12" arm)	£3 19 6
Goldring Headmaster high fidelity	£10 14 6
B.T.H. minor magnetic	£2 15 0

LOUDSPEAKERS

Magnavox, Rola, Amplion, M.S.P., Jensen. Available all impedances; special cones for P.A. work.

RECORD-PLAYERS—RECORDERS

Garrard type S rim drive with pickup	£6 2 6
Garrard type E gear drive with pickup	£7 15 0
Connoisseur—less pickup	£29 0 0
Garrard RC70 record changer	£11 17 6
Garrard RC65 record changer (mixed records)	£18 0 0

RECORDERS

B.R.S. Two Speed	£48 0 0

Stocks available of all amplifier and sound requirements.

JOHN MARTIN PTY. LTD.

116-118 CLARENCE ST., SYDNEY. 'PHONE BX5061

HOW TO WORK OUT YOUR GRID BIAS

MOST valves require the grid to be operated at a potential slightly negative with respect to the cathode. The provision of this voltage, or bias as it is called, is an interesting subject but one which puzzles beginners.

Battery bias is the simplest method and the easiest to understand. Briefly, the cathode, or filament, is connected to earth and the grid connected to the negative terminal of the bias battery. The positive terminal is connected to earth. The presence of the grid return resistor, if there is one, has no effect on the bias voltage applied to the grid, since there is no current flowing and, therefore, no voltage drop across it.

BATTERY BIAS

Battery bias has the disadvantage that the batteries require replacement every so often, and for this reason is not frequently used in receivers of modern design. The general aim of modern designers is to make receivers dependant on a single supply source, such as a 6-volt battery or the 240-volt AC mains.

There are special cases where it is most convenient to use battery bias, however. One such case is the 32-volt receiver described in this issue. Here, the high-tension voltage is limited and it is not desirable to subtract the bias voltage from it. Further, the valves are operated in class AB1 and require a well-regulated bias voltage.

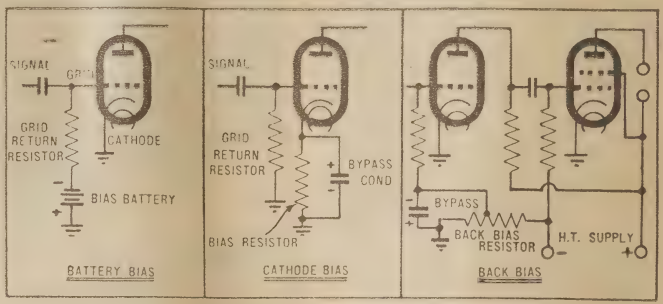
Battery bias also finds application in high-powered modulators and transmitters, where the bias supply is required to have good regulation. In this case the expense and work of replacement are negligible, since the equipment requires regular maintenance in any case. Furthermore, the batteries last their shelf life. Special cells for this purpose, with an extremely long shelf life, have been developed and, although they are not available in this country at the present time, are frequently used overseas.

It is possible to use the current drain through the valve itself to provide the bias and obviate the need for a special battery. This method is known as cathode bias.

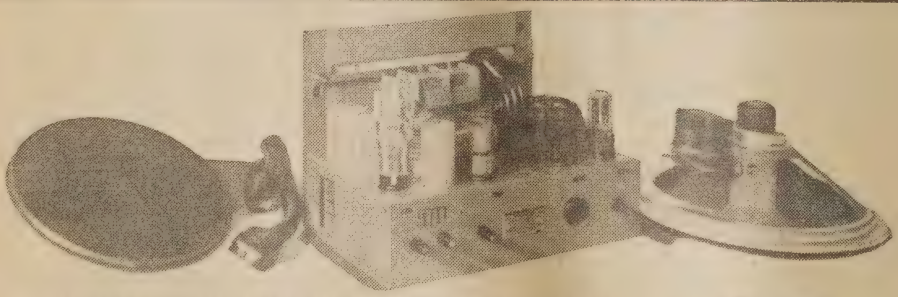
If a resistor is placed in the cathode lead of a valve the current drawn by the valve also flows through the resistor. This causes a voltage drop across the resistor. If the grid is returned to earth, it is then effectively negative with respect to the cathode because the cathode is positive with respect to earth.

SPECIAL CASES

Where there is no grid current flowing, the grid return resistor cannot have a voltage drop appearing across it. In special cases where there is grid current flowing, the resistance in grid circuit must be kept low, otherwise the bias will



Three methods of obtaining grid bias.



★ SIX-VALVE DUAL-WAVE RADIOGRAM CHASSIS
★ IMPORTED COLLARO RADIOGRAM-UNIT {WITH AUTO-MATIC STOP.}
★ 12 INCH PERMAGNETIC SPEAKER

20 GNS. COMPLETE F.O.R.

COMPARE THESE FEATURES:—

6 valve world range chassis.—Uses new Radiotron X61M converter valve giving better long distance reception.—High gain audio with inverse feedback and tone control giving you the best reproduction from your favorite recordings.—Radio-gramo switch combined with short wave switch.—A.C. switch incorporated with tone control.—Provision for F.M. or television tuner.—Large calibrated edge lit dial with main stations in each State in prominent type, with counterweight drive.

LARGE VARIETIES OF COMBINATION CABINETS AVAILABLE FROM £13/10/-

Manufacturers of Commercial Receivers for 12 years. CLASSIC RADIO *Manufacturers of Commercial Receivers for 12 years.*

245 PARRAMATTA RD. HABERFIELD. SYDNEY. UA2145

CLASSIC RADIO GIVES YOU THE SET YOU HAVE BEEN WAITING FOR AT THE PRICE YOU CAN AFFORD TO PAY

depend on the amount of the grid current.

Actually, use is made of this fact in transmitters where grid leak bias is often used for special reasons. However, this is a special case and there are several good reasons why grid leak bias cannot be used in ordinary receivers and amplifiers. In cases where grid current flows with ordinary amplifiers, care is taken to keep the grid circuit resistance low. This is done either by using a transformer or a choke in place of the grid return resistor, and a bias source with good regulation such as a battery or a special bias supply.

When using cathode bias it is necessary to bypass the bias resistor, if it is desired to prevent degeneration and consequent loss of gain. If the resistor is not bypassed, part of the alternating component of the plate current will appear across it. This will be out of phase with the signal voltage which is applied between grid and cathode and also appears across the resistor. The purpose of the bypass condenser is to provide an easy path for the alternating currents while having no effect on the steady bias voltages.

CALCULATION

The value of the bypass condenser depends to some extent on the value of the resistor, but mainly on the frequency at which the amplifier is operating. It may have a capacitance of anything between 10 and 50 mfd. for audio amplifiers and .1 mfd. for amplifiers operating at low radio frequencies. At radio frequencies between about 3 and 30 mcs. .01 fmd. is quite common.

The calculation of the value of the cathode bias resistor is quite simple. Take, for example, the 2A3 output triode. Reference to the valve characteristic chart will show that the standard class "A" operating condition is 250 volts plate supply and -45 volts on the grid. The table will also show that under these conditions the valve will pass a plate current of 60mA. A simple Ohm's Law calculation will show that the resistor which will give a voltage drop of 45 with a current of 60 mA. is 750 ohms. Note, in this case, that the total supply voltage is 295.

The same calculation can also be applied to tetrodes and pentodes. In this case, remember that the screen current also flows through the bias resistor and should therefore be added to the plate current for the purposes of calculation.

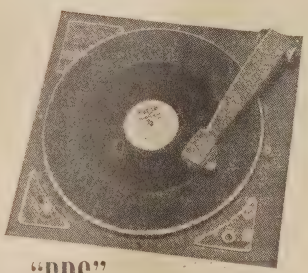
A third method of obtaining negative voltage for the grids of valves is to place a resistor in the negative supply lead. The total current of the particular piece of equipment then flows through this resistor. This is usually known as back bias.

Back bias has the advantage of better regulation than cathode bias and is often used for this reason alone. In cases where a number of valves require the same bias potential, it effects a substantial saving in components. In battery sets, where the valves do not have an independent cathode, back bias is often the

(Continued on Page 79)

Recording Pleasure

Just a flick of a switch . . . the adjustment of a control . . . and you're making your own recording — perhaps your child, who may be a promising artist, yourself or your friends with musical talent. Indeed, many musicians are clubbing together to own a "BRS" Recorder and Playback Unit, because it makes accurate study of their techniques easy and it is a permanent record of achievement.
Recording, too, of any radio programme is a simple matter so that recording in your own home affords continual personal pleasure.



"BRS" R12D
RECORDER & PLAYBACK UNIT

USE THE R12D IN YOUR RADIOGRAM

The R12D Recorder and Playback Unit connects to your receiver, radiogram or, if you like, a separate amplifier. You can then record from any programme or a microphone. As each recording is cut, it may be played back immediately. The unit also plays ordinary records as a pick-up combination.

Low priced, Byer acetate recording blanks are available in sizes from 8" to 16". These blanks have a life in excess of 100 playbacks. Ring, write or call for full information.

INTERSTATE REPRESENTATIVES:

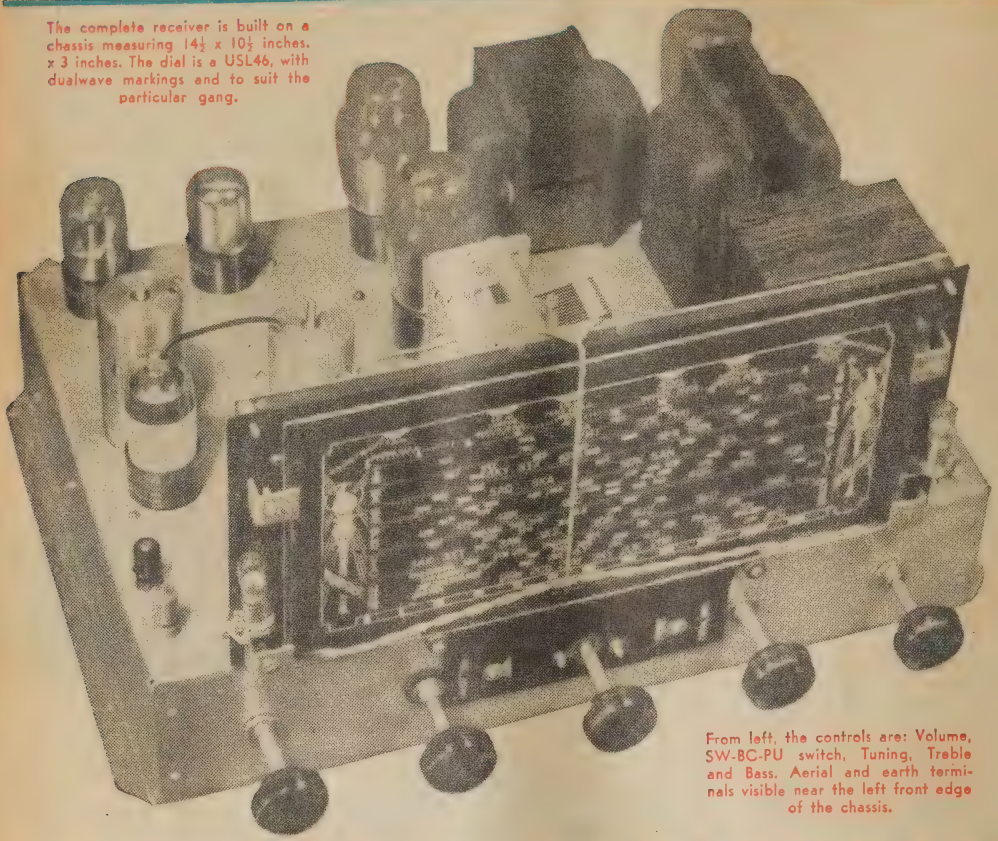
- N.S.W.: Wm. J. McLellan & Co. Pty. Ltd., 55 York St., Sydney. Tel.: BX 2508.
- QLD.: A. E. Harrold, 123 Charlotte St., Brisbane. Tel.: B 2729.
- S.A.: L. S. Wise & Co., 14 Pirie St., Adelaide. Tel.: Cen. 818.
- W.A.: Carlyle & Co. Ltd., 915 Hay St., Perth. Tel.: B 9371.
- TAS.: J. Garnham & Co., 113 Elizabeth St., Hobart.
- N.Z.: Swan Electric Co. Ltd., Wellington, Christchurch, Auckland, Dunedin.

Manufactured by

BYER INDUSTRIES
PTY. LTD.

8 DORCAS STREET, SOUTH MELBOURNE, VICTORIA.

TEL: MX4238.



The complete receiver is built on a chassis measuring 14½ x 10½ inches. x 3 inches. The dial is a USL46, with dualwave markings and to suit the particular gang.

From left, the controls are: Volume, SW-BC-PU switch, Tuning, Treble and Bass. Aerial and earth terminals visible near the left front edge of the chassis.

THE 1950 RADIOGRAM

Our first big set for 1950 is this modern radiogram which has all the essential features built around a total of just seven valves. It has full compensation for a lightweight pick-up, separate bass and treble controls, push-pull output and a dual-wave superhet tuner.

THERE has been tremendous interest, in recent years, in recorded music and, no matter how many receivers or amplifiers we describe, there seems always to be scope for a design with different features and capabilities.

Looking back over past issues, we have catered freely for those with modest requirements, with the "Advance," the "Tablegram," the "Lightweight Six," and so on. They are all good sets, every one of them, but naturally limited to the capabilities of a single output valve.

At the other end of the scale we had the "807 Radiogram" and the "TRF Majestic," with enough power to fill the largest home. Any apprehension we might have felt about the cost of building such sets was soon dispelled by the number of kits which our advertisers disposed of.

This new set is aimed at the "in between" market in terms of cost, but it has the advantage of a more up-to-the-minute design. Only the most ambitious listener could possibly want anything more elaborate.

AUDIO END FIRST

The natural impulse, when designing any radiogram, is to consider first the audio amplifier, and this set was no exception.

At the outset, we pre-supposed that it would be used with a lightweight pickup. While there are still plenty of the older variety around, they can hardly be considered seriously by anyone aiming to get the best from their records. The wear and tear on the grooves is serious by modern standards and the frequency response both limited and peaky.

What is even more important, improved recording standards are in the offing, and the special pickups required will certainly follow the modern lightweight trend.

In terms of electrical design, this means that the audio amplifier must have more gain than usual and incorporate appropriate correction in the bass register.

The additional gain and fixed correction is not required for radio reception so that it is logical to provide a special input channel for the pickup, exactly as we did in the case of the "Lightweight Six."

Over and above the fixed pickup

correction, it is necessary to consider also the matter of tone control, and something more elaborate than the traditional top-cut device is warranted in a quality receiver. The top-cut control is handy, of course, when playing worn discs or for occasions when the music is deliberately made unobtrusive.

Equally important, however, is the facility of controlling the bass response to suit individual tastes, recordings and variations in playing level. While one can argue for hours about these matters, there is little doubt that a spot of bass boost can give a most pleasing effect under some circumstances.

EXTRA GAIN

Automatically, the ability to boost any part of the spectrum means a reserve of unused gain somewhere in the system and, in the normal way, it involves an extra stage.

After that we can begin talking about the normal voltage amplifier, the phase splitter, output valves and rectifier. Add to this a minimum of two valves for the tuner and the total threatens to become rather large.

Fortunately, it is possible to make use of the popular 6SN7-GT twin triode, which compresses four stages into two valves. The only problem is that of overall gain, but—again fortunately—a pair of high slope tetrodes can be used in the output stage, allowing a useful degree of feedback to be employed without amplifying too far their drive requirements.

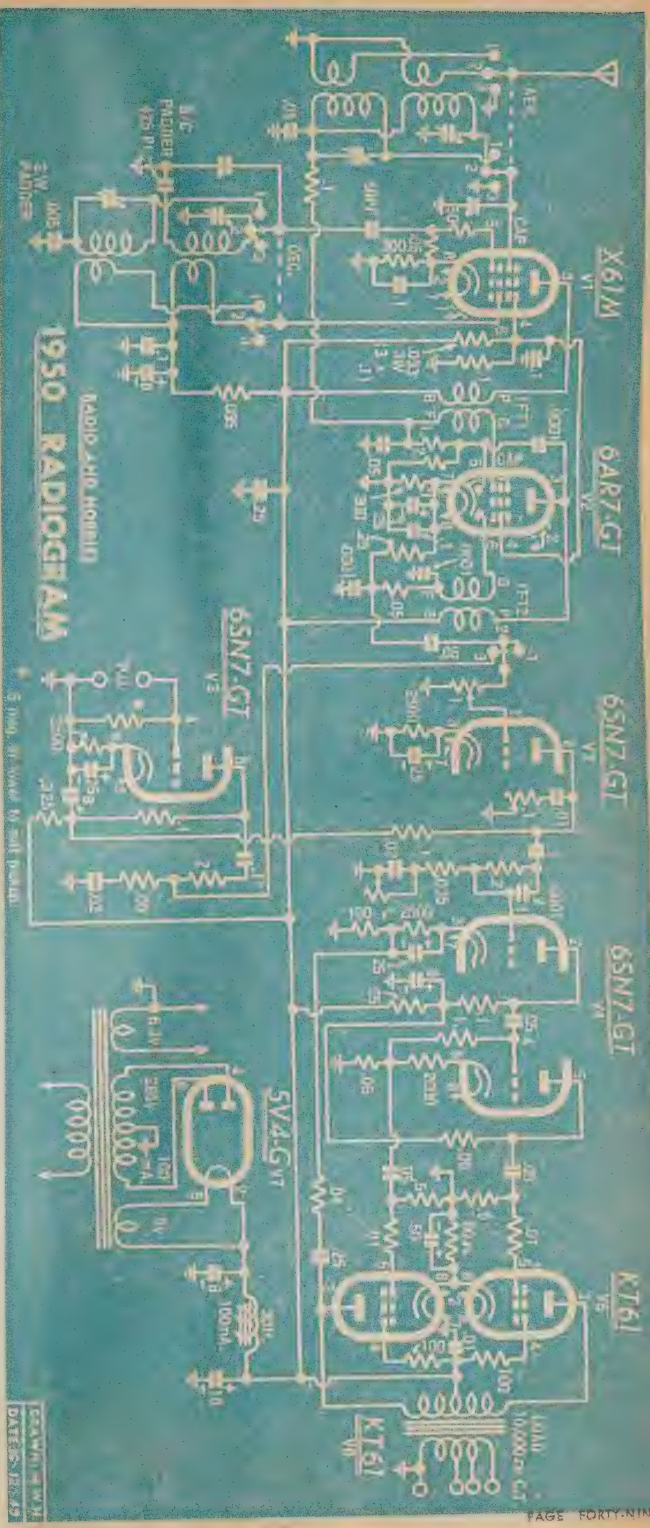
Looking at the actual circuit, it will be noted that the one half of the first 6SN7 is used only for the pick-up channel, its output being selected, when necssary, by the radio-pickup switch.

The components in the plate circuit are proportioned deliberately to contribute a small amount of gain and something less than the full required 6db/octave of bass boost. This boost will be assisted in most cases by the low frequency arm resonance, but it will normally be somewhat less than optimum requirements.

ADDITIONAL BOOST

The pickup can be used conveniently with this amount of boost for high level work. However, additional bass boost can be provided by the bass control operating on the next stage. This same boost is operative also for radio programmes.

Since the gain of the triode is only moderate, overloading is not likely to occur with the output of a lightweight pickup fed directly into the grid circuit. However, if you are apprehensive on this score, it is a simple matter to connect a preset control in the grid circuit, adjusting it so that the set just overloads on



There are no fancy tricks about the circuit, although there is a lot of it. Use of two twin triodes reduces the total number of valves.

Announcing yet another Australian valve development

HIGH-GAIN

DUO-DIODE PENTODE

WITH "FORMED" GRID CONSTRUCTION

Completely self-shielded internally as well as externally, its super-control characteristic enables the 6AR7-GT to handle the high signal levels without distortion.

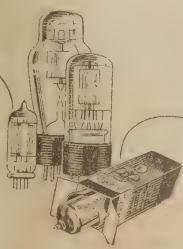
Outstanding performance is achieved when the 6AR7-GT is used in the intermediate frequency—detector stages of straight and reflexed broadcast receivers circuits.

Its development by Amalgamated Wireless Valve Company makes possible the manufacture of low-priced, 4 valve radio receivers providing sensitivities of the order of from 20 to 25 micro-volts in straight sets and from 1 to 2 micro-volts in reflexed versions.

RADIOTRON 6AR7 - GT TYPICAL OPERATING CONDITIONS

(Pentode Unit)

E_f	6.3 Volts
I_f	0.3 Amp.
E_b	250 Volts
E_{c2}	100 Volts
E_{C1}	-2 Volts
G_m	2500 Micromhos
R_p	1.0 Megohm



Radiotron

MADE IN AUSTRALIA

VALVES

AMALGAMATED WIRELESS VALVE COY. PTY. LTD., 47 YORK ST., SYDNEY

loud passages with the main gain control full on.

In any case, the grid circuit should provide for the pickup whatever load is specified by the manufacturers. Needless to say, there will be no need to connect in this grid circuit any bass compensating network, since this function is performed by the stage itself.

If, by any chance, you plan to use a conventional high output pick-up for the time being, it can alternatively be fed directly to the selector switch, bypassing the first stage. Ordinary crystal pickups do not require additional gain or boosting, although their response curve can often be improved by feeding them into a simple resistance capacitance network.

SECOND STAGE

The second stage is generally similar to the first, except that the initial gain is a trifle lower and the bass compensation curve follows a slightly different law. The compensation is also variable. Another potentiometer and condenser in the plate circuit give the desired treble control.

The second 6SN7-GT provides the regular voltage amplifier and phase splitter—a scheme which is very hard to get past for this type of work. The high gain of the output valves makes decoupling desirable both for stability and hum reduction and this applies even to the phase splitter.

Like most other high slope valves, the XT61 output tubes require grid and screen suppressors to ensure stability, mounted right at the valve pins. Make a point of keeping the plate wiring clear of other leads and for preference, earth the secondary winding of the output transformer.

The feedback circuit involves a network between the lower output plate and the cathode circuit of the main voltage amplifier. While it could have been taken over the whole output transformer, the present arrangement avoids the most serious complications of phase rotation and renders the circuit independent of the voice coil impedance.

FEEDBACK

Only a moderate amount of feedback has been employed but, if it is found that the amplifier has more gain than is requqired, the feedback can be increased by pushing up the value of the 100 ohm resistor in the 6SN7 cathode circuit.

While a push-pull output transformer is generally better than its single-sided counterpart, it is wise not to be niggardly in this respect. If the purse will cover a more elaborate type than is usually fitted to the speaker, it is a good investment. The power transfer will be higher and frequency response generally better.

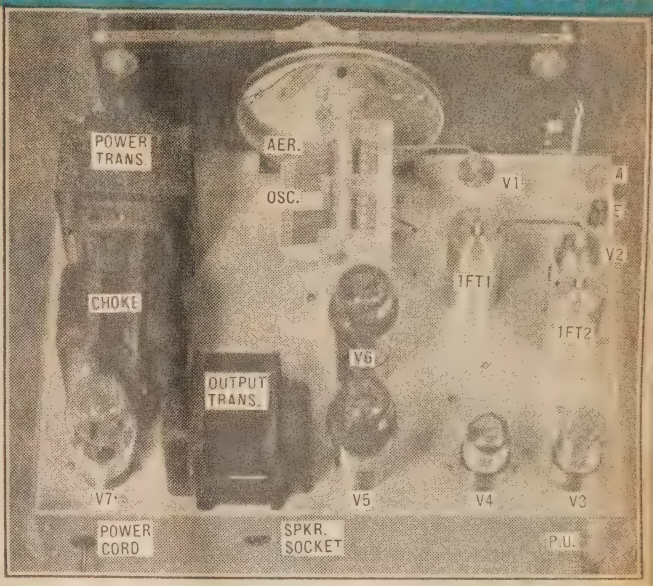
The power supply is quite a standard affair and should present no special problems. We suggest a vertical mounting power transformer to keep eddy currents out of the chassis, the transformer being mounted for this very reason in the corner remote from the pick-up channel.

The choke also must be a good one, with plenty of iron and some guarantee that the inductance under load is in line with the specifications. No hum should be audible more than a few inches from the speaker.

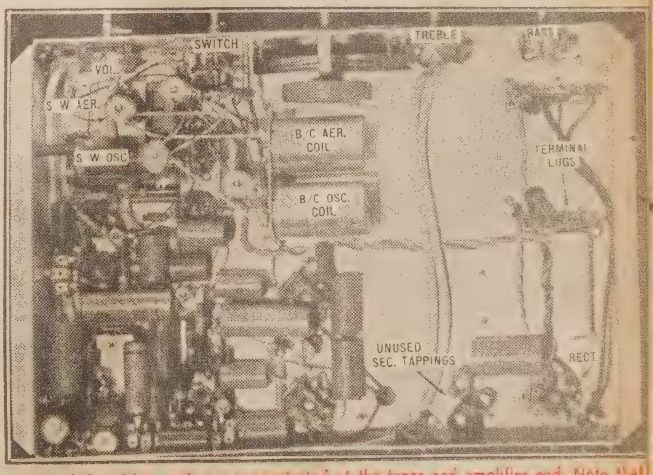
The tuner holds no special surprises, apart from the fact that it uses two of the latest high gain valves. Performance is very good on both broadcast and short-wave and adequate for anything but difficult country areas.

You can please yourself about the dual-wave feature. Some readers will want it, others will not. Normally, we would have used a standard dual-wave bracket but few, if any of the smaller ones are fitted with three-position switch. To economis

REAR VIEW OF THE RADIOGRAM



Note that the output transformer is mounted alongside the output valves, connection to the speaker voice coil being via a miniature plug. The output transformer should preferably be mounted on the chassis, irrespective of its type.



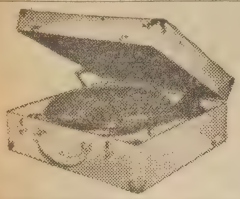
Most of the wiring parts are concentrated at the tuner and amplifier end. Note that the unused tappings of the multiple output transformer are curled up out of the road. They must not short to anything and must not be cut, unless the two ends are soldered again to maintain continuity.

Homecrafts PTY. LTD.

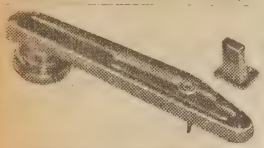
NEW YEAR RADIO BARGAINS

THE NEW "ZEPHER" LAND SPRAYER

Has hundreds of uses. As illustrated small size, 24/6. Large size, 26/6.

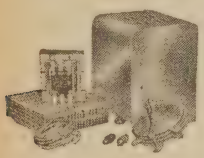


Capitol Gramo. Unit. Variable speed English Collaro Electric motor and pick-up in streamlined leatherette carrying case. **12 Gns. complete.**
£2/12/- Deposit, 3/6 Weekly.



PICK-UP BARGAIN

English Cosmocord brand new streamlined Crystal pick-ups. As illustrated. Reduced from £3/7/9 to **32/11.**

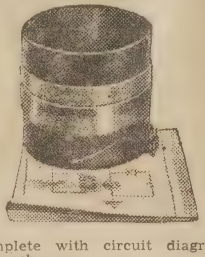


Battery Charger Kit. Homecrafts 6 volt 4 amp. Battery charger kit. Kit includes 6 volt 4 amp. English Selenium Rectifier, transformer, black crackle finish metal case, 2 terminals and hook-up wire. Complete kit, as illustrated, only £4/10/-. 12 volt 2 amp Kit, 5/- extra.

E.M.A. Flexible Couplings. Polystyrene insulated. Sizes ¼ x ¼ or ¼ x ½. Price, as illustrated, **4/6.**

Super Transmitting Tube Bargain. Brand new American Imported Elmac 100TH Tubes. As illustrated. Reduced from 8 Gns. to **49/6.**

BURON CRYSTAL SET COILS



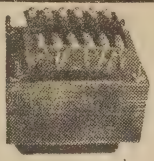
Complete with circuit diagram. **4/- each.**

The New English Collaro Record Changer. Type RC.49. This modern streamlined record changer is fitted with a high fidelity crystal pick-up and will change eight 10" and 12" mixed records. Price, as illustrated, only **£14/8/6 complete.**

New B.A.I. High Fidelity Crystal Pick-up Heads. Suitable to replace all Collaro or Garrard Magnetic Pick-ups. When ordering, advise is required for Garrard or Collaro pick-ups. Price, **45/-.**

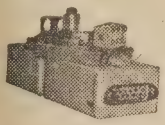
CHOKES

Pye wound R.F. Chokes. R.C.S. R.F85. 2/11 each.



Power Transformer Bargain. Brand new 100 m.a. Power Transformer with standard windings. Reduced from 45/- to **24/11.**

CAR RADIO KIT



Radio and Hobbies Car Radio Kit. As described in May issue of "Radio and Hobbies." Homecrafts special concession offer of this kit complete to the last nut and bolt, **only 18 Gns.,** as illustrated.

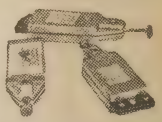
PORTABLE RADIO OWNERS

Any ordinary battery portable can be operated from the 230 volt mains with the new portapac. Price as illustrated, **£8/12/6.**

CAPITOL EXTENSION SPEAKER

The New Capitol Extension Speaker. In steel crackle finish cabinet with cord and switch. Colors: Cream, grey, or black. Price, complete as illustrated, **45/-.**

PICK-UP CARTRIDGES



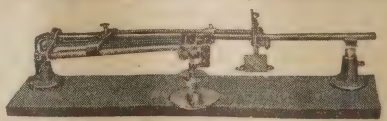
Bargain Pick-up Cartridges. Genuine Cosmocord Crystal Pick-up Cartridges, **9/11.**

RECORDING ENTHUSIASTS

Mechanoid cutting heads. A low priced cutting heat (500 ohms impedence) with outstanding performance. As illustrated, price only **£5/10/-.**

KINGSLEY I.F. TRANSFORMERS

I.F. Transformers. Brand new genuine Kingsley 455 Kc. I.F. Transformers. Latest type, as illustrated. Reduced from 13/9 to **6/11.**

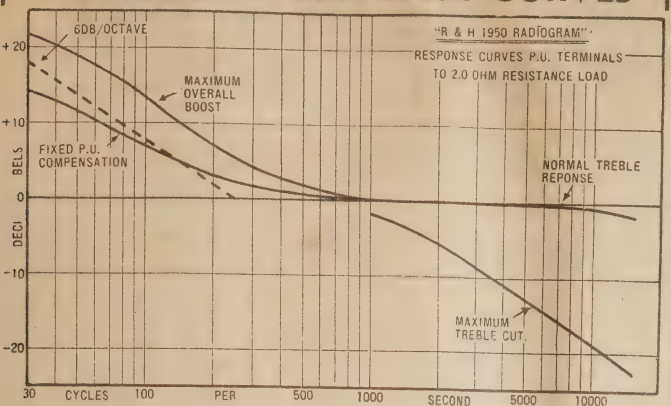


Capitol Traversing Gears. Overhead Traversing Gears for Recording from 8" to 16" Discs. As illustrated, **5 Gns.**

COUNTRY AND INTERSTATE CLIENTS ADD FREIGHT OR POSTAGE.

290 LONSDALE STREET, MELBOURNE. — CENT 4311

RADIOGRAM RESPONSE CURVES



Here are the response curves for the audio end of the set. The fixed bass boost does not operate on the radio channel.

PARTS LIST

1 Chassis 14½ x 10½ x 3 inches.
1 Power transformer 285v. a side at 100 mA, 6.3v. 3A, 5v. 2A.
1 Filter choke, .30 henries 100 mA.
1 Output transformer, voice coil to 10,000 ohms CT. (OP57 or similar).
1 Two-section gang (AWA or Stromberg).
1 Dial to suit, with dual-wave markings (USL46 or similar).
1 Set of broadcast coils (aerial and osc.).
1 Set short-wave coils (aerial and osc.).
2 Standard IF transformers, Nos. 1 and 2.
1 3-pole, 3-position, 2 bank rotary switch.
4 3-30 pf. trimmers.
7 Octal sockets.
1 Miniature 4-pin socket and plug.

VALVES

1 X61M, 1 6AR7-GT, 2 6SN7-GT, 2 KT61, 1 5V4-G.

RESISTORS

1 2 meg.
2 1 meg. potentiometer.
2 1 meg.
3 0.5 meg.
1 0.25 meg.
2 0.2 meg.
1 0.1 meg. potentiometer.
5 0.1 meg.
6 0.05 meg.
1 0.04 meg.
2 0.35 meg.
1 0.033 meg. 3W (3 0.1 meg. in par.).
1 0.025 meg.
2 0.01 meg.
3 2500 ohms.
1 2000 ohms.
2 300 ohms.
3 100 ohms.
1 80 ohms wirewound.
1 50 ohms.

CONDENSERS

1 50 mfd. 40 PV. electro (2 25 mfd. in par.).
4 25 mfd. 40 PV. electros.
1 16 mfd. 525 PV electros.
4 8 mfd. 525 PV electros.
2 0.25 mfd. tubular.
6 0.1 mfd. tubular.
6 0.05 mfd. tubular.
2 0.02 mfd. tubular
2 0.01 mfd. tubular.
1 0.005 mfd. mica.
1 425 pf., 5% tol. mica.
4 100 pf. mica.
1 50 pf. mica.

SUNDRIES

4 Terminals (2 red, 2 black), 4 7-tag mounting strips, 1 8-tag, 2 3-tag, 6 feet shielded hook-up, 6 feet 4 or 5 mil. spaghetti, 5 1-inch tapped mounting pillars, 2 small grid clips, 5 knobs, 2 dial lights, scrap aluminium for broadcast coil bracket, power flex and plug, 1 rubber grommet, hook-up wire, tinned copper wire, 1 or 2 mil. spaghetti, nuts and bolts, solder, solder lugs, etc.

in control knobs, we wanted a single selector switch, and there was nothing for it but to provide the right switch and wire in separate coils.

If you do not want the short-wave coverage, simply omit the coils and instal a radio pickup switch. It would need to select the appropriate input channel and silence the tuner on the "pickup" position by shorting the aerial and/or the converter signal grid.

The full wiring of the dual-wave switch is shown in our circuit diagram, with the short-wave, broadcast and pickup positions occurring in that order. On the "pickup" position, the switch is wired to short the aerial and converter signal grid to earth, effectively silencing the tuner. The broadcast oscillator coil should be bridged across, however, so that the oscillator section will continue to operate.

This is a very desirable precaution, since any interruption to the oscillator or the removal of the oscillator anode voltage may cause another electrode to draw excessive current.

McGILL'S

Est. 1860

A BRIEF SELECTION FROM OUR LARGE RANGE OF TECHNICAL BOOKS

	Price	Postage
PHOTOGRAPHY AS A HOBBY, Barton. Deals with cameras, exposures, developing, printing, enlarging, color, home movies, etc.	3/6	3d.
HOW TO BUILD 20 BOATS Complete plans for Sailboats, Rowboats, Outboards, Sport Craft, Cruisers from 8 to 42 feet.	6/3	3d.
HOME OWNERS' ANNUAL Home Planning, Remodelling and Repairing	3/-	3d.
CRAFTSMAN'S ANNUAL. Instructions for making Miniature Jeep, Drill Press, Colorprint Projector, Writing Desk, Photo Enlarger, Cupboard, Boat Trailer, etc.	3/-	3d.
HOME WORKSHOP ANNUAL. 65 practical things to make — Desk, Table, Paper Cutter, Invalid's Chair, Bed Tray, etc.	3/-	3d.
BOAT BUILDER'S ANNUAL. Plans and Instructions for 28 easy-to-build boats	3/-	3d.
MODEL BUILDER'S ANNUAL. Projects for the Model Engineer	3/-	3d.
HOW TO BUILD IT— Manual for the home craftsman. More than 100 project plans and ideas for your workshop hobby	7/-	3d.
HANDY MAN'S HOME MANUAL. Easing household tasks; modernizing old furniture, home repair, etc.	7/-	3d.

Popular Mechanics Publications

BUILD A BOAT FOR PLEASURE OR PROFIT. How to build 17 different kinds of water craft, including a rowboat, canoe, sea sled and 18 ft. Fast Cruiser.	15/-	8d.
FARM MANUAL—288 pages of profitable farm workshop ideas.	10/-	5d.
SHOP NOTES, 1950. 240 interest packed pages for Mechanic, Painter, Carpenter, Auto Worker, Electrician, etc.	10/-	5d.
WHAT TO MAKE, 1950. Instructions and plans for furniture, novelties, toys, games, gifts, etc.	10/-	5d.

Plus exchange.
Mail Orders by Return.

McGILL'S

AUTHORISED NEWSAGENCY

183 ELIZABETH STREET, MELBOURNE.

"The G.P.O. is Opposite."

DISPOSAL BARGAINS

A.S.V. RECEIVERS

190 to 220 MEG, 14 Valves 6-6AC7, 2.954, 2.955, 6N7-2x2, 5v4, 6H6. Converts to 144 Meg. or Em. Good Order.

£8'8'-

NEW 3 GANG S.T.C. CONDENSORS

.0001 M.F.D. Ideal for S.W. Convertor or Communication Receivers

10'-

NEW S.T.C. VIBRATOR TRANSFORMERS

6V INPUT
400V 200 M.A. OUT

£2'10'-

NEW FS6 OR 101 PLUGS AND CABLES

COMPLETE SET

7'6

NEW MN26C A 12 VALVE RECEIVER

Covering 150 to 1500 KC, 5-6K7, 2-6K7, 2-6J5, 1-6L7, 1-6B8, 1-6F6 a 112 K.C. if channel sensitivity better than 1-microvolt. Conversion circuit diagram with each unit.

GENEMOTORS

INPUT	OUTPUT		
12V	500V	160MA	4 10 0
60R12	500V	160MA	8 10 0
24	450	215MA	2 5 0
24	300	215MA	2 5 0
24	360	200	3 10 0
24	250	100	2 0 0
24	575	350	3 10 0

NEW GLIDE PATH RECEIVERS

An excellent pre-AMP unit. 3.6C6 Valves in shock mounted cabinet.

£3'17'6

NEW 2 GANG A.W.A. CONDENSORS

.0001 M.F.D.
FOR THAT CONVERTOR

6'9

NEW A.W.A. VIBRATOR TRANSFORMERS

6V INPUT
225V 60 M.A. OUT

17'6

HEAD PHONES

LOW IMPEDANCE HEAD SETS WITH CORDS & JACK PLUG

8'6

COMPASS RECEIVERS

COMPLETE SET £17/10/-
LESS MOTORS £14/10/-
LESS MOTORS & VALVES

£8'10'-

GENEMOTORS

INPUT	OUTPUT		
6V	250V	60MA	2 0 0
12V	250V	60MA	1 10 0
12V	210V	50MA	1 10 0
12V	345V	50MA	1 10 0
12V	480V	50MA	1 10 0
24	450	50MA	1 10 0

NEW SB2 U.H.F. RECEIVERS

A super Regen Receiver using 3.954, 1-955 Valves. Slug lined. Covers 235 to 258 MEG. Converts to 144 or 288.

£4'-'-

NEW 3 GANG RADIO-CORP. CONDENSORS

.00025 MFD.

10'-

NEW A.W.A. VIBRATOR

POWER SUPPLIES 6V INPUT
90V 30 M.A. OUT

£2'15'-

NEW I.F.F. CONTROL BOXES

Containing 2 Cutler Hammer Toggle Switches and 6 position Rotary Switch and other useful parts.

2'9

USED MN26C COMPASS RECEIVERS

GOOD ORDER
LESS VALVES & MOTORS

£6'15'-

Conversion Circuit Supplied.

6-AK5 VALVES

17'6

PHONE LA1604

EXCELAIR RADIO

136 VICTORIA RD., MARRICKVILLE, N.S.W.

PHONE LA1604

Trimmers are required on all coils, irrespective of whether the coils have any iron slugs or not. The slugs are handy for low frequency adjustments, but that is all.

Standard high gain IF transformers can be used and, provided due care is taken with the wiring, no special difficulties should be experienced with instability.

VALVES

Concerning the choice of valves, the X61M can be replaced with similar results by the ECH35 or the ECH33. Other converters like the 6J8-G can be used, with some reduction in gain and, in certain cases, an adjustment to the operating conditions.

In the same way, the EBF35, EBF32 or EBF2 will replace the 6AR7-GT with equivalent results. The 6G8-G will give considerably lower IF gain, although still adequate for all normal requirements.

The general layout of the chassis is clear enough from the photographs. To minimise risk of hum with the full bass boost in operaton, we took pains to separate the audio input channel from the power equipment, the two being in diagonally opposite corners of the chassis.

While it was completely effective in our case, it did mean that most of the small components were concentrated at one end and forethought is necessary to achieve a systematic layout. However, use small components wherever possible and the task of fitting everything in will be considerably lightened.

LAY-OUT

As far as possible, the components associated with each stage should be grouped around the socket. This is particularly important in the converter stage where we found that running the screen bypass in particular to the earthing point of the IF stage promoted definite instability.

Make sure also to place the AVC bypass and the oscillator anode bypass close to the short-wave coils, likewise the short-wave padder.

Use single point earthing as far as possible for the early audio stages. Leads to the volume and tone controls should be run in shielded hookup, with the shielding earthed only at the valve end. It is generally wise to avoid earthing the circuit near the control, since eddy currents from the chassis can easily be introduced in this way into the audio circuit. A length of heavy gauge sleeving, slipped over the shielded wire will prevent it shorting to other components or making intermittent contact elsewhere with the chassis.

The broadcast coils are mounted on a bracket directly beneath the gang condensers and are placed sufficiently high on the bracket so that the slugs can be reached without trouble.

The coils we used have the slug screws protruding from the top of

(Continued on Page 89)

ROLA
IMPROVED DESIGN!!
PERMAGNETIC SPEAKER RANGE NOW AVAILABLE

Model	Cone		Retail Price Ea.
3C	3"	without transformer	20/8
3C	3"	with type L transformer	26/4
3C	3"	with type G transformer	25/9
5C	5"	without transformer	23/2
5C	5"	with type G transformer	27/11
5C	5"	with type E transformer	25/11
6H	6"	without transformer	30/5
6H	6"	with type D transformer	34/8
6L	6"	without transformer	36/11
6L	6"	with type D transformer	41/2
8M	8"	without transformer	40/1
8M	8"	with type C transformer	45/7
8MPA	Special P.A. Speaker Less		40/1
10M	10"	without transformer	52/6
10M	10"	with type C transformer	58/-
120	12"	without transformer	65/1
120	12"	with type C transformer	70/5
12U	12"	without transformer	£11/3/4
12U	12"	with type B transformer,	£11/15/5
12/50	12	Henry 50 M/A choke	6/2
14/60	14	H. choke	8/-

When ordering state type of output valve being used. We will then supply the correct transformer.

GOLDRING "HEADMASTER"
Hyperfidelity PICK-UP

Outstanding for perfect reproduction because of the INTERCHANGEABLE Pick-Up heads for every type of record. This special feature completely eliminates surface noise and distortion. The heads are as simple to change as a needle—no time wasted—and the price remains the same as any other usual type lightweight Pick-Up.

Complete with 3 Cartridges ... £10/14/6

Replacement Cartridges and Needles ea. ... 28/6

Write for detailed literature.

JANUARY SPECIALS

Trutrak Magnetic Pick-ups	17/11	5,000 ohm and 10,000 ohm ½ watt carbon resistors, doz.	9d.
Ethertone Magnetic Pick-ups	20/-	10,000 ohm Carbon Potentiometers	1/6
Dulcie Carbon Microphones	4/9	Metal Multimeter Cases and Panels	12/6
6 Volt 135 Volt Vibrator Transformers	12/9		

HOMECRAFTS PTY. LTD.

(Division of Electronic Industries Ltd.)

Showrooms and Wholesale Department:
100 Clarence Street, Sydney. BX4451

MAIL ORDERS: Box 5000, Sydney.

Despatch Department BX3379. Also at 26 Hunter St., Newcastle.

Follow the Crowd to Reliance!

See the most extensive, and varied array of radio models in all Australia!

Reliance SKY-RAIDER WORLD RANGE RADIOGRAM

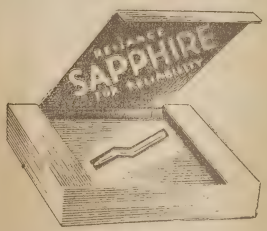
Only 36 Gns. COMPLETE!

- Miracle long distance reception with revolutionary new valves!
- Equipped with new type 12" speaker PLUS exclusive Reliance PROJECTOPHONIC REAL LIFE tone!
- Sockets for extension speaker and television unit!

NO AGENTS—You Buy Direct!

When you come to Reliance YOU WILL NOT FIND A SHOP OR A WINDOW DISPLAY! Right NEXT DOOR to the Lottery Office you enter a porch and take a few steps to see THE GREATEST ASSORTMENT OF RADIO MODELS IN ALL AUSTRALIA! The model illustrated is but one of many beautiful DETAIL FINISHED, up to the minute models that instantly appeal to the discriminating radio enthusiast who likes to buy the best at the lowest possible price! Yes, our easy terms are available throughout N.S.W.! Attach the coupon (at right) to your inquiry for a catalogue.

Reliance Releases New English SAPPHIRE NEEDLE!



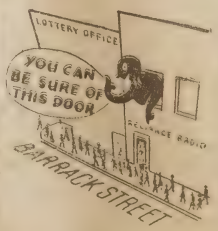
ONLY 8/6 POST FREE

RELIANCE RADIO

Manufacturers & Distributors Phones BX 2691-2-3

10 BARRACK STREET, SYDNEY.

Exactly next Lottery Office



Mail This

Attach the coupon to your letter. We will send full details of our easy terms and free freight plan.

RELIANCE **SKY KNIGHT**

5-Valve WORLD RANGE Radiogram CHASSIS UNIT

£19/19/-

Very Easy Terms in Sydney and Metropolitan Area.

A **FAMOUS** NAME IN RADIO BEHIND THIS SET!

The Reliance Sky Knight is a companion to the famous Reliance Sky Raider and Sky Masters, backed by over 20 years of technical experience in producing communication type receivers and the luxury type multi-valve sets. The Reliance Sky Knight brilliantly combines many of the distinguished features of these super sets and it comes to you in COMPLETE form to enable you to fit it to your own cabinet easily and at low cost! If you wish, we will supply a cabinet, motor and P/U or record changer at low prices, too!

RELIANCE GIVES YOU THESE ADVANCED FEATURES!

- New type variable Tone Control which gives much more efficient mixing of Bass and Treble notes than ordinary types.
- Inverse Feed Back, automatic volume control, FM PLUG-IN, extension speaker socket.
- RADIO GRAMO switch combined with wave change switch.
- Type EF50 valve for NOISE FREE LONG DISTANCE RECEPTION.
- Latest type 12" Permanent magnet speaker.

FREE PACKING—FREE AIR FREIGHT.

Wherever practicable we despatch by AIR FREIGHT. This is FREE IN N.S.W. and to Melbourne and Brisbane. Nominal charge elsewhere. The set is securely packed in a special carton. There is NO CHARGE for packing.

SPECIAL NOTICE

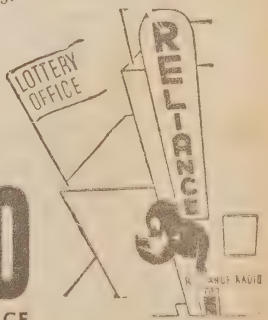
Owing to the great demand for Reliance Sky Raider and Sky Master models we are reluctantly compelled to discontinue the Sky Knight radiogram chassis. In order not to disappoint R. & H. readers we will be prepared to supply a Sky Knight unit at any time during January and February if immediate application is made enclosing this notice.

Write Or Call For Full Technical Details

RELIANCE RADIO

10 BARRACK ST., SYDNEY, NEXT DOOR TO LOTTERY OFFICE

Telephone: BX2691-2-3.



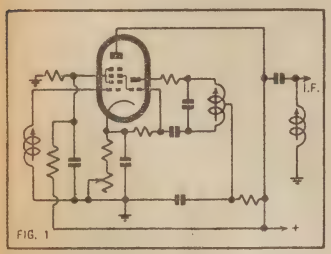
"YOU can be sure of THIS door"

A COURSE IN TELEVISION

PART 8—SUPERHET MIXER VALVES

The performance of a television receiver depends a good deal on the mixer/oscillator stage, particularly in respect to the ease and stability of tuning. This article discusses mixer valves in general and suggests circuit arrangements which are most commonly used overseas. Oscillators will receive special mention in the next article.

IN last month's article on RF amplifiers, particular stress was laid on signal-to-noise ratio, with some mention also of "front-end" gain. In choosing a mixer valve, the same factors have to be considered, though to a somewhat lesser extent.



Triode hexode converters are favored in England where television services operate at 50 odd mc. Their characteristics deteriorate rapidly at higher frequencies.

Assuming that the RF stage gives useful gain, its characteristics will very largely govern the signal-to-noise ratio of the whole receiver. However, if the RF stage gain is comparatively low, as with some simple triode circuits, it is still possible for a mixer valve to contribute to the general noise level. Notoriously bad arrangements must therefore be avoided.

At the same time it is desirable to preserve reasonable "front end" gain, if only to simplify the design of the IF channel. Thus the selection of a low gain RF amplifier stage makes it desirable to use a high gain mixer, preferably with a good signal-to-noise ratio.

Conversely, where a high gain RF stage is used, more liberties can be taken with the mixer.

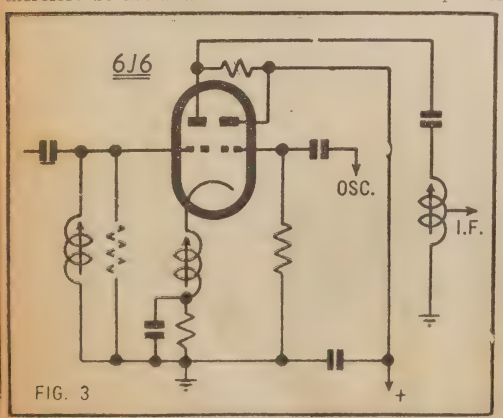
Of course, not all television receivers employ an RF stage. The omission simplifies the tuning mechanism, but can lead to severe radiation of the local oscillator frequency. Furthermore, it throws on to the mixer valve the full responsibility of the signal-to-noise ratio. A careful study of valve types and circuitry becomes necessary if the receiver is to have reasonable performance.

The whole question of an RF, stages, noise ration, gain, &c., involves economic as well as technical considerations. In areas of high signal intensity, very simple designs may be successful, exactly as on the normal broadcast band. In other areas, where signal is less strong, the differences between a poor receiver and a good one will be immediately obvious.

FREQUENCY CHANGER

The operating frequency has a good deal to do with the choice of frequency changer.

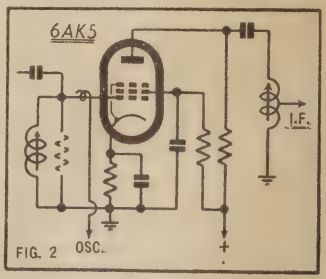
In England, where the television services operates on about 45 Mc., it quite feasible to use conventional converter valves like the 6K8, ECH35, X61-M — types with which Australian readers are quite familiar. The latest miniature converter is the 6BE6, introduced originally with an eye to FM services between 80 and 100 Mc.



A cathode coupled mixer using a twin triode. The noise factor is low but gain is only moderate.

Figure 1 shows a typical triode-hexode converter, as applied to a television receiver and drawn as a triode-hexode should be drawn.

The signal is fed to the grid by way of a tuned circuit, the inductance of the coil being varied to resonate with the total circuit capacitance. Since there is only one programme source, the question of variable tuning does not arise. Furthermore, although no loading is shown across the tuned circuit, it would normally be loaded by the aerial, the plate resistor of the previous valve or by a physical resistor.



A grid injected pentode mixer has a much better noise characteristic than the triode hexode and gives extremely high conversion gain.

The screen and cathode circuits are more or less conventional.

The oscillator employs a Hartley circuit with the ends of the coil effectively above earth. Since no tuning gang or switching is involved, this leads to no difficulties. At the most a trimmer would be accessible for ready adjustment to the oscillator frequency, should any drift occur.

A damping resistor is normally included in the grid or plate circuit to prevent "squegging," while the total "C" in the circuit may amount to 50 or more pf. as an aid to stability. This is only possible, of course, because of the relatively low operating frequency of English television receivers.

PLATE FEED

The hexode plate is fed through a resistor of 1000 ohms or thereabouts and capacitively coupled to

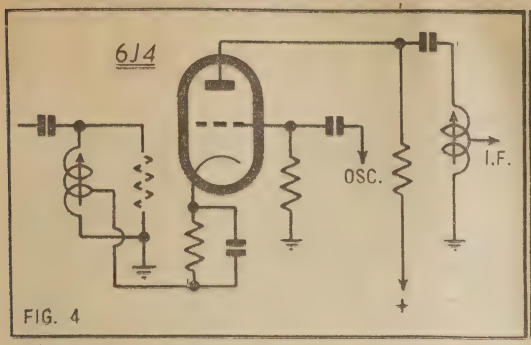


FIG. 4

A "grounded grid" mixer. The signal is fed to cathode, while the oscillator voltage is connected to the grid.

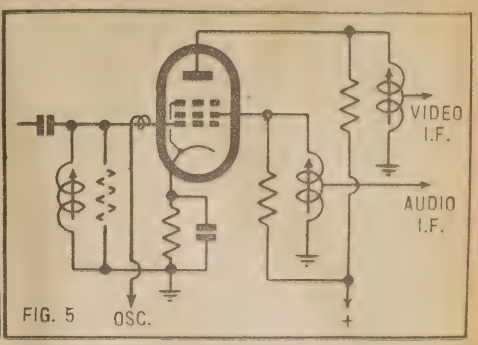


FIG. 5

A novel scheme for separating the video and audio I.F. signals. One channel is fed from the plate, the other from the screen of a pentode mixer.

the resonant output coil. The resistor provides a d-c path for the plate current and limits the "Q" of the plate coil, effectively increasing its bandwidth.

Many variations are possible from this circuit but it is typical of those adopted by English designers.

Broadly speaking, converter valves are more noisy than either triode or pentode mixers, due to the multiplicity of electrodes and the resulting partition currents. However, the more advanced designs, like those mentioned, operate passably well in the 50 Mc region and allow the saving of one valve. They also simplify the construction to some extent, the injection being effected within the converter valve.

Sufficient to say that the majority of British television receivers use a combination converter valve of one type or another. The performance, both in respect to noise and gain, is poorer than the alternative of a pentode mixer with separate oscillator, but the compromise is generally admitted on economic grounds.

In fringe areas the use of a more ambitious design would be advantageous. Local amateurs, operating on the 50 Mc band, will readily appreciate the force of these remarks.

IN AMERICA

In America the situation is completely different. The frequencies allotted to television services extend upwards to 216 Mc and receivers have to be designed accordingly. The performance of current converter valves deteriorates so rapidly, as frequency rises, that they have been largely rejected by American television designers.

On economic grounds the number of valves is of less moment in the US and may even provide a useful sales feature.

Every effort must be made to achieve a high signal-to-noise ratio and to ensure good performance at the higher frequencies. The obligation to provide variable tuning and a wide band aerial is likely to reduce efficiency, compared with what could be achieved in a single frequency installation. Any limitation on the amount of signal reaching the first grid only emphasises the need for low valve noise.

However, more important than any of these factors is the matter of oscillator stability. The sound channel, in particular, is relatively narrow and, whether FM or AM, will produce severe distortion if there is any substantial drift in the local oscillator frequency. Drift can ultimately affect the picture as well, but the sound channel is always the first to suffer.

The problem is such that it demands the closest possible attention and the performance of ordinary frequency changers is not good enough in this respect at the higher frequencies.

Much the same will be true in Australia, since the proposed service will operate in the vicinity of 200 Mc.

Before going further, however, it may be wise to mention the types of mixer circuits which are finding favor with television designers.

As in the case of an RF stage, a pentode mixer valve gives high conversion gain with a moderately good signal-to-noise ratio. Perhaps the best of the current miniature pentodes is the 6AK5, and a typical circuit arrangement is shown in figure 2.

The grid is capacitively coupled to the previous tuned circuit, which may be the aerial coil itself or the plate circuit of an RF amplifier. The signal from the oscillator is injected into the signal grid also through a very small coupling capacitance.

In practice, grid injection is to be preferred over other methods, giving maximum conversion gain and the best signal-to-noise ratio. Suppressor injection affords isolation of the oscillator and signal frequency circuits, but the operating conditions of the mixer valve have frequently to be limited to avoid excessive screen dissipation.

SCREENS AND CATHODES

The screen and cathode circuits are conventional, but the plate is conveniently fed through a resistor which serves also to load the output circuit. This allows the resonant plate coil to be grounded and tapped to provide a low coupling impedance to the IF channel.

The conversion gain of the 6AK5 mixer is such that it can be preceded successfully by any of the RF stages already mentioned. Best gain figures are provided by two 6AK5 pentodes —RF amplifier and mixer—the noise figure being moderately good.

A better signal-to-noise ratio is provided by a 6J4 as cathode follower triode amplifier ahead of the 6AK5 mixer, but the improvement is achieved at the expense of gain.

Figure 3 shows another popular arrangement, using a high-slope twin triode as a cathode coupled mixer. The first triode receives the signal input voltage and has the IF coupling coil in its plate circuit. Once again the damping resistor can be used as a d-c feed path.

The signal from the local oscillator is fed to the second grid, the plate of the second triode being earthed. Coupling between the two triodes is provided in the common cathode circuit, which contains a bias resistor and a broadly resonant RF choke.

Higher conversion gain is obtained by resonating the cathode circuit sharply to the oscillator frequency, but an additional tuning circuit is required.

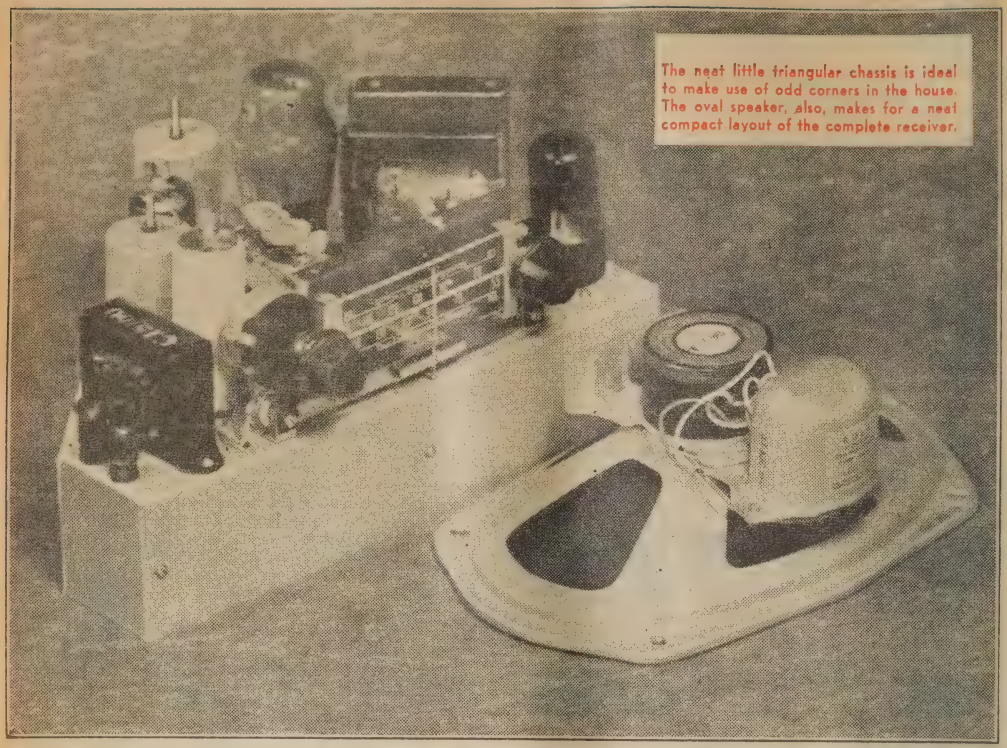
CONVERSION GAIN

The conversion gain is from one-quarter to one-half that of the 6AK5 mixer — depending on the cathode tuning—but the noise figure is better. The difference in noise content is not important, however, when preappear to have the obvious advantage.

Figure 4 illustrates a single high slope triode connected as a grounded-grid mixer. The signal is fed to the cathode circuit, and, to match the very low input impedance to the stage, the cathode connects to a tapping on the input coil. The grid is coupled to the local oscillator and the plate circuit contains the usual damping resistor and tapped output choke, resonant at the intermediate frequency.

As might be expected, the circuit offers a good signal-to-noise ratio in itself, but once again the difference compared with other mixers is not important when preceded by an RF

(Continued on Page 83)



The neat little triangular chassis is ideal to make use of odd corners in the house. The oval speaker, also, makes for a neat compact layout of the complete receiver.

THE CORNER SET WITH AVC

The "Corner Set," described last month, looks like being a worthy successor to the famous "Little General," many thousands of which have been built during the last 10 years. In the "Little General" tradition, we give in this article full instructions on adding A.V.C. to this "peppy" little set.

AS soon as we switched the set on and lined it up last month, we knew it was a winner! Our high opinion of it has since been confirmed by several weeks of use and by complimentary remarks from various well-known trade identities. The modern, high gain valves give the set a performance well ahead of any straight four valve set it has hitherto been possible to design.

SIMPLE FORM

The omission of AVC, of course, makes the original version ideal for beginners, since the number of components is cut to a minimum consistent with good results.

However, there are certain worthwhile advantages to be had for those who feel confident to handle the slight extra wiring complication involved by adding AVC. It prevents loud bursts of signal as the set is tuned across the band, and, with an efficient AVC system, it is often possible to set the volume control on one of the local stations and then tune in all the other local stations without noticeable change in volume.

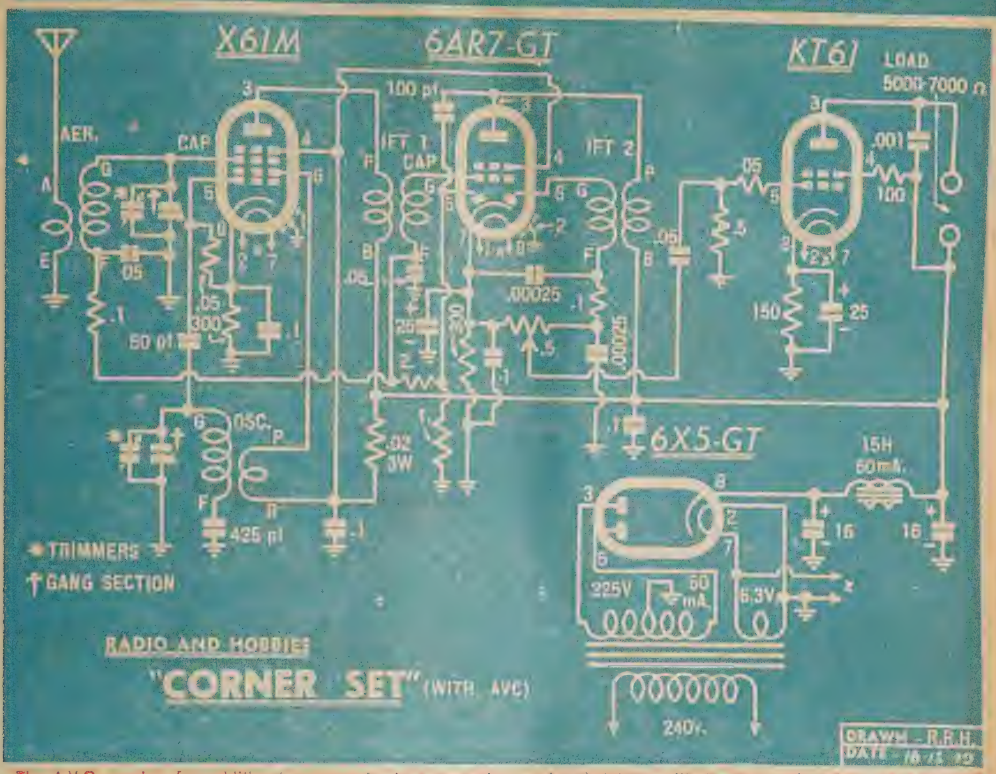
If you wish to listen to an interstate station between the locals, the set automatically adjusts itself to the required sensitivity. This, added to the list of features already mentioned, makes a very smooth and efficient receiver.

The overall maximum gain of the tuner section is very high. However, the chances of oscillation occurring are negligible when manual RF gain control is used because the control is always set at something less than maximum gain. In the case of an AVC controlled RF section, the gain automatically adjusts itself to maximum with no signal or a very weak signal. For this reason we have taken the precaution of decoupling the AVC control and cathode circuits of the mixer and IF stages in the new version.

BUILD IN STAGES

If you like the AVC feature, but are not confident of successfully completing the slightly more complicated wiring, build the simple version described last month first, and add the AVC later. There

CIRCUIT OF THE CORNER SET WITH AVC



The A.V.C. requires few additional components. As a precaution against instability with the high gain valves, we have used separate bias resistors and decoupled the A.V.C. circuit.

only two inexpensive components which need be discarded. If you are a beginner, keen to learn about radio, the modification job will be good experience.

We have set out the changes in a step-by-step fashion, so that they will cause you least difficulty. They are as follows:—

1. Disconnect all the components and wiring from both the X61M and 6AR7-GT cathodes, except the .05 meg. resistor in the case of the X61M and the .00025 mfd. condenser in the case of the 6AR7-GT. Install separate 300 ohm resistors from both cathodes to earth. In the case of the X61M, bypass the cathode to earth with a .1 mfd condenser. (The .25 mfd. condenser used in the original set may be used here if desired.)

Bypass the 6AR7-GT bias resistor with a 25 mfd and a .1 mfd condenser and connect a length of hook-up wire to the cathode.

2. Remove the 5000 ohm wire-wound potentiometer and install a .5 meg unit of the carbon variety. To the most clockwise of the potentiometer terminals, looking from the front, connect the lead from the 6AR7-GT cathode.

Connect the centre arm of the potentiometer to the .05 mfd coupling condenser via a length of shielded wire. The coupling condenser and shielded wire junction is best supported by a lug of an insulated tag strip installed for that purpose. The remaining connection to the potentiometer is returned to the RF filter (junction of .05 meg and .00025 mfd) via another length of shielded wire.

CONVERSION STEPS

At this stage, the set has audio volume control, but no means of controlling the gain of the RF section. It will work if you switch it on but it will probably distort on strong signals.

3. Disconnect the "F" connections for both the aerial and IFT1 coils from earth. Bypass the aerial coil connection so isolated with a .05 mfd condensr and connect it to IFT1 via a .1 meg resistor. Bypass this point, also, to earth with a .05 mfd condenser.

4. Isolate one of the 6AR7-GT diodes and from it connect a .0001 mfd condenser to the 6AR7-GT plate, a 1.0 meg resistor to earth and a 2.0 meg resistor to the "F" connection of IFT1.

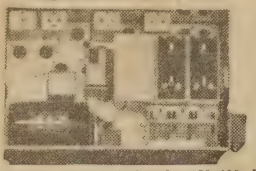
The conversion job is now complete and when you switch the set on, you will find that it will tune smoothly from station to station without distortion. Some of the settings may have been disturbed during the conversion so that it is a good plan to re-align the receiver.

You will notice that the settings are much less definite than they were in the previous version. This is because the automatic volume control tends to counteract any changes in signal strength made by the alignment. However, we have arranged the circuit in such a way that the AVC does not come into operation until a certain signal strength is reached. This allows maximum sensitivity on weak signals.

RE-ALIGNMENT

Therefore, when you are aligning the receiver, either by ear or with the aid of an audio output meter turn the audio gain control near full on and work with a weak signal. This is fairly easy to arrange if you have a signal generator, but is more difficult if you have to depend on broadcast stations. In the latter case, wait until you can do the job in daylight when the band is not crowded and choose stations with weak but steady signals.

BENDIX AIRCRAFT COMMUNICATIONS RECEIVERS RA10FA



Frequency range 4 bands 150-400 kcs, 2.0-5.0 mcs, 2.0-5.0 mcs, 5.0-10.0 mcs. H.T. dynamotor 24v input 250v at 100 mA output. Small 24v A.C./D.C. motor. Filaments wired for 6v A.C./-D.C. Socket ready mounted and space for rectifier and A.C. power supply. Valves used: 3—6SK7, 6K8, 6R7, 6C5, 6H6, 6K6.
Price, less valves F.O.R. **£11/10/-**
Remote control box with calibrated dial, etc., to suit above. Each 35/-

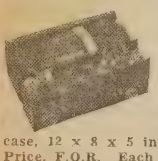
POTENTIOMETERS

0.5 megohm carbon	1/6
25,000 ohm carbon	1/-
5,000 ohm 25w, I.R.C.	4/6
500 ohm midget carbon	1/6
250 ohm 25w, I.R.C.	4/6
6 ohm wire wound	2/-

METERS

0-3.5 mA. D.C. 2½ inch round flush	17/6
0-10 mA. D.C. 2½ inch round flush	7/6
0-30 mA. D.C. 3 inch round flush	25/-
0-50 mA. D.C. 3 inch round flush	25/-
0-30 volt D.C. 3 inch round flush with datum indicator	30/-
0-350 mA. R.F. thermocouple, New	15/-
0-1 amp. R.F. thermocouple, New	15/-
Used	10/-

SCR 522 GENE MOTORS



28 volt input D.C., regulated and filtered output filtered D.C. 300 volts at .26 amps; 150 volts at .01 amps; 14.5 volts at 5.0 amps.
Completely shielded in metal case, 12 x 8 x 5 inches.
Price, F.O.R. Each **45/-**

GENERATORS

24 volt 60 amp D.C. (F.O.R.). Each **£11/10/-**
Ideal for home lighting plants, battery charging, plating, etc. Also available Bendix voltage regulator and cutouts 30v. 50 amp. Brand New. Each **57/6**
Suitable for use with above generators.

SIGNAL GENERATOR COILS

100 Kcs—22mcs.
Brand new colpitts type. For use with A.W.A. 2 gang condenser giving complete coverage from 100 Kcs. to 22mcs. in six overlapping bands. Complete set of 6 coils **25/-**
Packing and postage: N.S.W., 9d; Interstate, 1/3.

1196 CRYSTAL OSCILLATOR UNITS

Contains 4 position crystal socket; 4 ceramic insulated midget variable condensers 75 mfd. with 1½ x ¼ inch shaft; 3-9 mcs. coil and 4 position switch. Complete in metal case 5 x 4 x 2½ inches.
Price **15/-**
Packing and postage: N.S.W., 1/3; Qld., Tas., Vic., 2/-; S.A., W.A., N.T., 2/9.

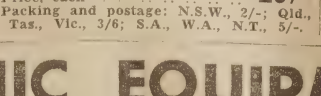
SPECIALS

TR1196 Transceiver, 3-9 mcs. with valves, power supply, 12 volt, each £8/10/-
TR1133 Transceiver, 100-124 mcs. with valves, less power supply, each, £8/10/-
TRI133 Genemotors, 12v. input, output DC, 300v. 240 mA., 150v. 10 mA., 6v. 5A., filtered each £4/10/-
Type "S" Power Supplies, AT5-AR8, 240v. AC input, output DC, 250v. 80 mA., 550v. 200mA., 300v. 100 mA., 12v. 5A. £18/10/-
AT5 Transmitters with valves less power supply £8/10/-
BC375 coil units, each £3/10/-
TA12C 100 watt Transmitters less power supply and mod. £14/10/-
Gibson Girl emergency Transmitters £3/10/-
108 MK2 Transceiver 6 to 9 mcs with valves £12/10/-
English I.F.F. Sets. Complete .. £3/10/-
American I.F.F. Sets. Complete, £4/10/-
W.E. F.M. receivers 29-40 mcs., 10 valves less power supply £17/10/-
A.W.A. U.H.F. receiver 190-210 mcs, 11 valve less valves and meter 65/-
ZB2-ARRI U.H.F. receiver 234-258 mcs. 4 valves, complete, new £4/15/-
Used £3/15/-
Bendix RAIODA remote control units. Each 35/-
24-volt solenoid 1 contact 5 amp. .. 6/-
6-volt solenoid 1 contact, 5 amp. .. 6/-
4-pin wafer sockets, doz. 3/-
VCR97 Cathode ray tube socket, each 5/-
Aircraft S.P.D.T. toggle switches, ea. 2/6
Phone jacks and plugs, pair 2/-, ea. 1/-
Co-ax connectors pye type, pr. 3/-, ea. 1/6
Vibrator "A" R.F. chokes, each .. 2/-
685 microhenry 500 mA. slot wound R.F. chokes, each 1/-
High to low impedance headphone adaptors, each 4/6
Variable tone buzzer transformer, ea. 3/-
Headphones, low impedance, each 7/6
Headphones, high impedance, each 17/6
Output transformers to low impedance headphones, each 5/6
Double button carbon microphones, each 7/6
Carbon throat microphones, each .. 7/6
Carbon microphone inserts carbon diaphragm, each 2/6
Dynamic No. 7 microphone inserts, each 6/-
Shielded hook-up wire, per yard .. 8d
Rubber covered stranded hook-up wire, per 100ft. 5/-
Westectors, each 4/6
Ceramic Formers 6 x 1¼ inch dia, ea. 3/6
Ceramic Formers 6 x 3 inch dia, ea. 5/-
Full wave bridge copper oxide rectifier, 100 mA, each 3/6
Half wave selenium 5 mA. rectifier, each 2/6
1 inch ceramic standoff insulators, ea. 1/-
¾ inch lead through insulators, each 1/-
Pressure gauges 2½ inches, 3000lb. sq. inch, each 25/-

COAXIAL CABLE

Polystrene Insulation.
PS 29/M 72 ohm, 60ft lengths only 7-16 inch O.D.
PS 11/M 72 ohm, 60ft lengths. Only 5-16 inch O.D.
Price, per length **30/-**
Packing and postage: PS 29/M, N.S.W., 2/-; Qld., Tas., Vic., 3/6; S.A., W.A., N.T., 5/-.
PS/11M, N.S.W., 1/6; Qld., Tas., Vic., 2/6; S.A., W.A., N.T., 3/6.

FIRE EXTINGUISHERS



Auto type. One quart capacity. Carbon tetrachloride. Pump action. A necessity for cars, trucks, caravans, yachts, factories, homes, etc.
Price, each **20/-**
Packing and postage: N.S.W., 2/-; Qld., Tas., Vic., 3/6; S.A., W.A., N.T., 5/-.

GENEMOTORS

Command type as illustrated, 28 volts, 1.1 amp. input. Output 250 volts, 60 mA. 32/6
14 volt input, output 220v. 70/80 mA. filtered 50/-
No. 11 type 12 volt input, output 350v. 40 mA. 30/-
12 volt input, output 480v. 40 mA. 35/-
28 volt input, output 330v. 135 mA. 65/-
28 volt input, output 550v. 350 mA. 70/-
TR1133 type, 12v. input, out DC, 300v. 240mA., 150v. 79 mA., 6v. 5A, filtered £4/10/-

240V. 50 C.P.S. Transformers

5000v. 30 mA.	50/-
375v. C.T., 375v. 100 mA. 5v. 3 amp., 6.3v. 3 amp high voltage insulation	30/-
350v. C.T. 350v. 150 mA. 5v. 2 amp.	25/-
335v. C.T., 335v. 150 mA. 5v. 2 amp.	25/-
275v. C.T. 275v. 40 mA. 6.3v. 3 amp.	13/6
6 volt 5 amp.	15/-
6.3 volt 1.5 amp.	12/6
240 volt and 20 volt X2 70 watts	15/-
240v.-110v. auto, 300 watt	37/6

FILTER CHOKES

150 mA.	20/-
100 mA. A.W.A. midgets	7/6

DISPOSAL VALVES, TESTED

1K7G	8/6	852	25/-
3Q5GT	10/-	954	12/6
6AC7	14/-	955	12/6
6AG7	20/-	956	12/6
6B6G	10/-	9001	10/-
6H6GT	7/6	12A6	10/-
6SH7	8/6	12SG7	10/-
6SH7GT	8/6	12SK7	10/-
6SL7GT	12/6	12SR7	10/-
6SN7GT	14/-	EA50	7/6
6U7G	10/-	CV6	8/6
7193	8/6	VT90 Micropop	10/-

NEW VALVES

1D8GT	15/-	6V6GT	12/6
6AK5	17/6	6X5GT	12/6
6B6G	12/6	7A6	10/-
6B8	15/-	7C7	11/6
6F6	15/-	7F7	11/6
6H6	10/-	7N7	11/6
6J5G	11/-	83V	11/-
6J7G	12/6	828	35/-
6K8G	12/6	832	70/-
6SG7	12/6	879/2 x 2	15/-
6SJ7	15/-	1293	11/6
6SK7	15/-	1294	11/6
6SQ7	12/6	VR54/EB34	5/-
6UG7	12/6	VR65A	5/-

4 W FLUORESCENT LAMPS

Colour: Blue. Length, 5½ inches. Ideal R.F. indicators.
Price, each **2/6**
Per doz. **25/-**

New W.E. Command Q5-ERS

Freq. range 190-550 Kcs. 85 Kcs. I.F. channel. Valve line up: 12SK7, 12K8, 12SK7, 12SK7, 12SR7, 12A6. One R.F. Stage, two I.F. Stages. Ideal for conversion to car radios or selective double conversion sets. Size: 4½ x 5½ x 16½ inches. Weight 6lb.
Price, complete with valves **£9/10/-**
Packing and postage: N.S.W., 2/-; Qld., Tas., Vic., 3/6; S.A., W.A., N.T., 5/-.
Also available 3-6 mcs. and 6-9 mcs. ranges complete with valves. NEW **£6/10/-**
Packing and Postage as above.

ELECTRONIC EQUIPMENT CO.

Please add exchange to all cheques. Make money orders and postal notes payable at Lewisham. Sorry, no C.O.D.

LM3555: 29B West St., Lewisham, Sydney. OPPOSITE END OF LEWISHAM HOSPITAL (ADJOINING RAILWAY LINE) LM3555

FROM THE SERVICEMAN WHO TELLS

I HAVE known the first one for some time and can remember visiting the home for purely social reasons at least two years ago. The radio happened to be playing at the time and the set was providing a most vicious background of 100 cycle hum behind the otherwise pleasant programme.

I could not help remarking on the fact and pointed out that it was almost certain to be due to failing filter condensers and that I could fix the matter very quickly for them for a few shillings.

The owner agreed that perhaps the hum was a "bit high," although he really hadn't taken much notice of it.

The incident faded from mind and was completely forgotten until a few weeks ago, when I had to visit the same home.

STILL HUMMING

Imagine my feelings when I heard the same set playing much the same sort of programme, but with an even higher hum level. A further remark brought forth the disinterested explanation, "Oh! The hum—we are so used to it that we don't even notice it!" I am afraid that I gave up in disgust.

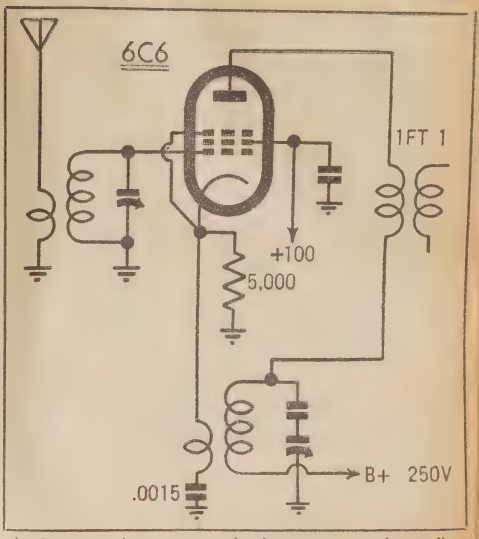
Just as I was leaving, however, the owner mentioned that he was going on holidays and, perhaps, after all, it would not be a bad idea to get the set checked over and "perhaps I could do it."

I did it all right, and installed some new dial lamps as well, so they would know when the set was on!

The other receiver was owned by a rather mature business girl in an equally mature flat. It had been a good set, but its performance had gradually deteriorated until the last station was threatening to disappear from the dial. 2FC was the first to go, I was told, but there were seven other locals to listen to. I mentally calculated that the loss of one station only represented 12½ per cent!

But a little later 2BL also faded from the dial, and so on, until only a couple of the high frequency stations were left. At this juncture, the lass decided to do something about it. Hence my visit.

It turned out to be a fairly old superhet, with an autodyne converter. The converter had gradually weakened to the point where it would no longer oscillate when the set was tuned to the low frequency end of the band, hence 2FC disappeared. The oscillator cut in again between 2FC and 2BL, so that the latter station was not immediately affected. So, the process went on until she at last decided that the choice of programmes was becoming somewhat restricted.



A failing valve in this autodyne circuit eliminated the stations in turn beginning at the low frequency end.

If patience is in need of virtue, then some radio listeners must be well nigh angelic. On two separate occasions this month, I have had to stand back and admire the patience—or the endurance—of individual clients.

A new 6C6 restored life to the set and the new rectifier gave the other valves a better chance to do their stuff. A spot of adjustment and alignment and everyone was happy!

Getting on to subjects more technical, I had a visit recently from a young chap who had just completed a receiver. He had got it going well enough, but was worried by the fact that the transformer became warm enough to smell after about half an hour's operation. The circuit seemed OK, and a quick check of the voltages and wiring revealed nothing to explain the reason for the heating up.

By the time I had finished checking over the set, and outlining the most likely causes to the budding expert, the power transformer once again reached the stage where one began to look for a curl of smoke.

These days, transformers are frequently designed to operate with a heat rise of up to 30 or 40 degrees centigrade under full load, which means that they can get hot enough to be uncomfortable to the touch. However, the process should end there and all is well provided that there is a reasonable amount of ventilation. They get a lot hotter than that in the baking oven during the manufacturing process!

SMELLY

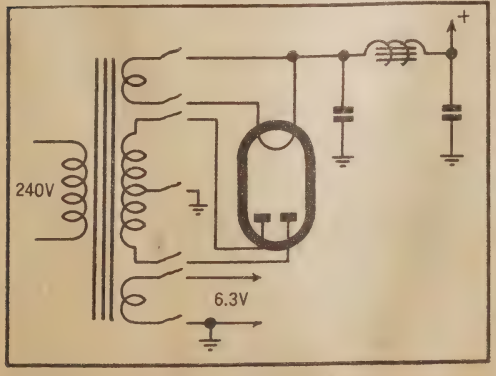
When a transformer reaches a "smelling" stage, however, there is something sadly amiss, and one can suspect either a fault in the transformer or in the wiring.

In this case, I could not see any shorts and the various voltages were close enough as not to be suspect.

One cannot be too fussy, of course, since the normal winding tolerances, plus the moderate accuracy of an ordinary AC voltmeter, can give a fair margin of reading error.

In the circumstances, I suggested that our friend take the set home and allow the transformer to cool down. Then disconnect all wiring from the transformer, &c., and see whether it still tended to overheat with nothing connected to it.

He duly reported back to me next day with the news that the transformer still got very hot, but not quite so quickly as when the set was connected. That put the matter beyond issue. The transformer obviously had a short between layers or between turns in one of the windings and was due for replacement.



To test a power transformer for shorted turns, it was operated with all secondary windings disconnected. Excessive heating indicated an internal fault.

! SAVE £20 !

Build this 6 valve

CAR RADIO

which also works off 240v A.C.

for only £16/19/0

6V and 12V Model

The Telecond

CAR-LECTRIC

New Model CL961

Car-Home-Travel-Radio

Revolutionary lay-out and simple, efficient circuit gives RANGE, volume and tone equal to best car radios on the market, while selectivity is notably superior. Full sized coils. Valves: 6SK7GT, ECH33, 6SK7GT, 6SQ7GT, 6V6GT, 6X5GT. Fits almost any car, rubber mounted between bulk head and dash. Taken out in few seconds for home or hotel use, it plugs directly into elect. power. Station calibrated dial. Easy to build.

WRITE FOR FREE DETAILED DESCRIPTION

KITSET, including Valves, full instructions, Sales Tax, with 5" speaker.
Special Price, £16/19/-
with 6" speaker .. .. £17/9/-.
12V Model .. .. .. 4/- extra.

COMPLETED SET with 6ft telescopic aerial, accessories.
List Price, 29gns.
Liberal Trade Discount.

PROMPT MAIL ORDER SERVICE
Add freight 19lb. "Fragile" (50% extra freight).

PLEASE, NO C.O.D.

SAVE MONEY, BUY DIRECT From Manufacturer

P. STEVENS

Radio Engineer and Consultant
21 FLETCHERS AVE., BONDI, N.S.W. FW6157.

Two service calls this month have been the direct result of mechanical failure in valves, as distinct from deterioration due to old age. I suppose that even servicemen show the effect of the passage of time!

One was a neat little mantel set which played well enough on some occasions, but on others produced a rough howl preceded by crackles, blurts and other rude noises. The owner's explanation was perhaps a little less graphic than mine, but it meant the same thing, and the first thought was for a faulty valve.

Almost any valve in a set can cause crackling, but a bad audio tube is usually responsible for a sustained howl. The tube shows microphonic tendencies which are aggravated by sound waves from the loudspeaker. Sooner or later, from continued vibration, the offending elements become sufficiently loose to rattle freely.

In other words, the speaker rattles the valve and the valve generates impulses to keep it going, until a howl develops. Ultimately the listener also becomes rattled.

ONE AUDIO VALVE

Since this set was of the traditional 3/4 variety, there was only one audio valve, namely a 6V6. This was sufficient in itself, because 6V6's, in common with other high-slope output valves, not uncommonly give this trouble.

The set was playing all right when I arrived on the scene, but a sharp tap on the 6V6 envelope produced a crackle in the speaker, and a few more taps made the set howl like mad.

I popped a new 6V6 into the socket, stuffed "the necessary" into my pocket and left with reasonable assurance that the set would henceforth behave itself.

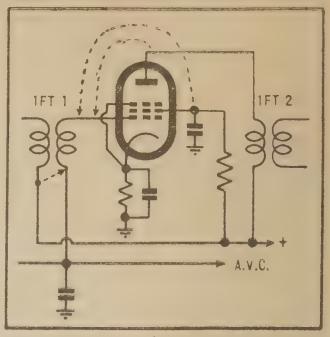
The second valve was a rather vicious one — at least in its effect on me.

The complaint on this occasion was intermittent operation and crackling which culminated in complete stoppage of the set.

There was nothing to indicate this time that it was valve trouble, although, of course, it remained a distinct possibility. Purely as a matter of routine, my first action was to reach into the back of the set — a conventional console — and check the seating of the valves in their sockets, grid caps, earthing of the shield cans, &c.

The moment I touched the grid cap of the IF amplifier, I let go very smartly and gave expression to a string of "ows" and "wows." Whatever there was on that grid was more than AVC volts!

The offending volts could be reaching the grid either by way of a coil or via the valve itself, so, very carefully this time, I slipped off the grid cap and proceeded to investigate the matter with my multimeter. There was no short in the IF transformer, as I had expected, but it was in the valve itself, and a subsequent check



Internal shorts within a valve put high tension onto the grid cap. A fault in the I.F. transformer would produce the same effect.

in the valve tester showed a short in every position of the switch.

I did not bother to trace out just which electrodes were involved, but from the way I jumped, the owner must have thought that I had collected a "belt" direct from the substation itself.

Now let me see. What other circumstance or incident can I think of which could possibly justify its inclusion in these columns? Ah, yes, I almost forgot!

MANTEL SET

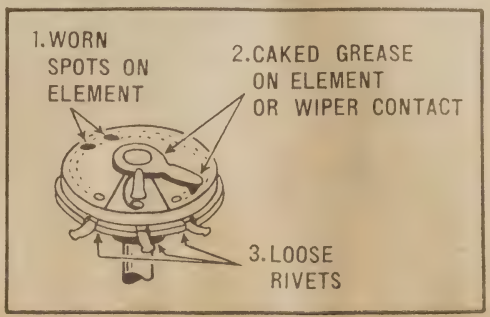
A mantel set came in for service, a well-known brand, and incorporating the 3/4 valve reflex circuit. The complaint was poor gain and selectivity.

I duly tested all the valves, half expecting to find a weak one, although I admit that a weak valve does not cause poor selectivity. However, the valves were OK, and a "run-over" with the multimeter revealed no suspiciously high or low operating voltages. It surely must need alignment!

The alignment was actually no more out than one would expect of a set several years old, and certainly not enough to explain the drastic loss in performance which had been reported to me.

I did notice that one of the IF trans-

(Continued on Page 77)

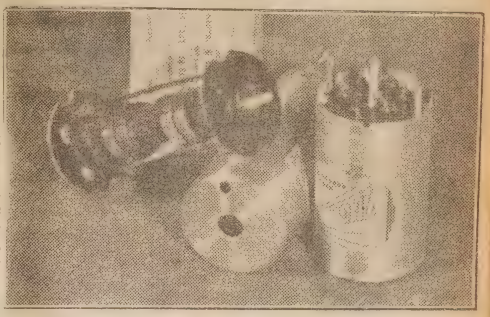


Three possible reasons for noisy operation of a volume control. Repair is seldom worthwhile unless no replacement control is available.

TRADE REVIEWS AND RELEASES

VEGA COILS, IF's AVAILABLE IN QUANTITY

A new line of coils and I.F. Transformers has appeared on the Australian market under the trade name "Vega." In addition to the standard components, miniaturised versions are available for use in portable and auto receivers.



"Vega" components are manufactured by Cranch Products and Trading Co., of 17 Bond Street, Sydney. Principal of the company, Mr. Lay Cranch, is widely known in the radio trade, having been closely associated with the design and marketing of "Kingsley" components.

The components shown on the right are of standard dimensions, housed in round aluminium cans and with 1 3-8" mounting centres. They were used with good results in the "1950 Radiogram," featured elsewhere in this issue.

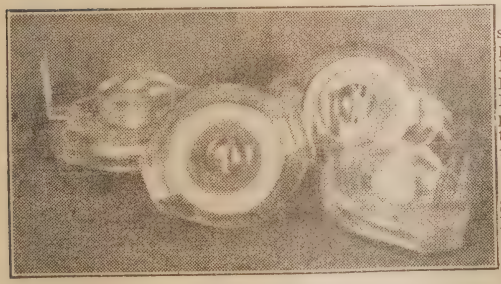
The range includes standard high gain I.F. transformers and low-gain medium selectivity types for two-stage operation. The windings are in two sections and wound with heavy gauge litz. Varying the slug position does not affect the coupling to any extent. Aerial, R.F. and oscillator coils are available to complete the range, also short - wave coils for either 13-42 or 16-50 metre coverage.

The miniature I.F. transformers are mounted in cans ⅝in square and 1 7-8in long. They are wound with litz wire and have an iron-dust external ring to limit the damping effect of the can. Miniature coils are also available to complete the set.

Development is proceeding on a series of dual-wave brackets.

NEW TRIMMERS, VALVE SOCKETS

Two new small-component lines have recently appeared on dealers' shelves, namely a small compression-type trimmer and an all-bakelite moulded wafer socket.



The trimmer referred to is marketed under the name "Jabel Junior" and retails for 11d. It is assembled on a moulded polystyrene base, oval in shape and just over ¾-inch long.

The bottom plate is tinplate, but the upper compression plate is of phosphor bronze. Selected mica forms the dielectric.

Careful shaping and trimming of plates produces a rated capacity range of from four to 50 pf., with good stability for this type of trimmer. The lugs are crimped into tapering slots to lock the plates more firmly in place.

Factory representative for Jabel products is Wattkin Wynne, 173 Pacific Highway, North Sydney. Supplies are available through normal trade houses.

The new sockets are Teletron type ST38, distributed in NSW by the Birnbach Radio Co., of 55 York St., Sydney. Moulded in first-grade black bakelite, the sockets a 1 1-8" dia. hole and have 1½" mounting centres. Three-point contact is provided with the valve pins, which are numbered for ease of reference.

GOODMAN'S AXIOM 22 LOUDSPEAKER

Catering for a special market, Goodman's Industries have released a speaker which combines high fidelity with large power handling capacity. It is listed as the axiom 22.

The new speaker is a logical development from the earlier Axiom 12 and R22. It has the same twin cone assembly as the Axiom 12 and substantially the same frequency response. Bass resonance is nominally 55c/s and the upper limit extends to the 15kc region.

A larger ring type magnet has been fitted, however, as for the high powered R22. It has a total flux of 195,000 Maxwells and a density across the gap of 17,500 gauss. This increased field density gives even higher power sensitivity than the Axiom 12 and still better transient response.

The Axiom 22 is available to order from United Radio Distributors, 175 Phillip St., Sydney. The retail price is £24/7/6.

IF YOUR SET LACKS PUNCH IT NEEDS *CROWN* PARTS

Does your set fall just short of expectations . . . go "on the blink" sometimes? You can rectify that—install CROWN components! The result will c nce you that you should ALWAYS DEMAND CROWN!

The Crown Permature Coil illustrated is made in Type No. P.C. 63 aerial, P.C. 64 RF and P.C. 65 oscillator. These coils are wound on trolitul formers and are moisture proofed against all climatic conditions.

Price **7/6**

Also below is the P12 standard 5-plate padder condenser. Of 455 K.C. using polystryrene base, this condenser is for use in conjunction with H. Gang condenser.

Price **2/6**

Crown Permature Coil

Padder Condenser

The 455 K.C. I.F. transformer above is the new P.T. 41-43 series. It is moisture proofed in the special R.C.S. process.

P.T. 41 1st stage
P.T. 42 2nd stage
PT. 43 low gain

Price 13/-

Crown
RADIO PRODUCTS PTY. LTD.
51-53 MURRAY STREET
PYRMONT — SYDNEY
Telephone MW2628 (2 Lines)

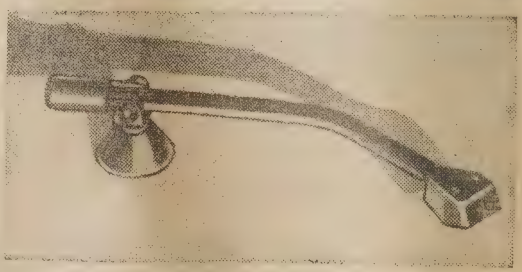
If your local dealer cannot supply, write directly to us.

DECCA ffrr

lightweight, low mass moving Iron

PICKUPS

This pickup, as used in the famous "Deccola" utilises a replaceable semi-permanent sapphire tipped needle armature, which ensures a perfectly smooth response from 30-14000 cps., without resonance within that range. Available in high impedance and low impedance.



• *For further information write, phone, or call at "The Helpful Wholesalers" today.*

UNITED RADIO DISTRIBUTORS PTY. LTD.

RADIO-ELECTRIC WHOLESALERS

Showrooms: 175 Phillip Street, Sydney. Offices: 183 Pitt Street, Sydney.

TELEGRAMS & CABLES: URD, SYDNEY TELEPHONES: MA 9251, MA 1563

PHILIPS INTRODUCE "INNOVAL" SERIES

Working in collaboration, Australian and Dutch engineers have evolved an important new technique in valve manufacture, which is claimed to be the most efficient system yet evolved. It is the basis of the miniaturised "Innoval" series, announced recently by Philips, and already available on the market.

OBJECT of the new technique has been to provide miniature valves with a sufficient number of pins to accommodate complex types and, in addition, to achieve greater accuracy and rigidity in the positioning of those pins. The high sealing temperatures previously necessary with other all-glass valves has made this difficult to achieve.

The "Innoval" series uses the standard American 9-pin "Noval" base, which forms the basis of the trade name. However, the pins are sealed into the base assembly in special jigs and the glass thereafter is not heated again sufficiently to become plastic.

The electrode structure is welded to the inner ends of the base pins, the multiplicity of support wires holding the whole structure very firmly. Low microphonic content is claimed as a result and, in point of fact, the manufacturers have published ratings for microphony under typical operating conditions.

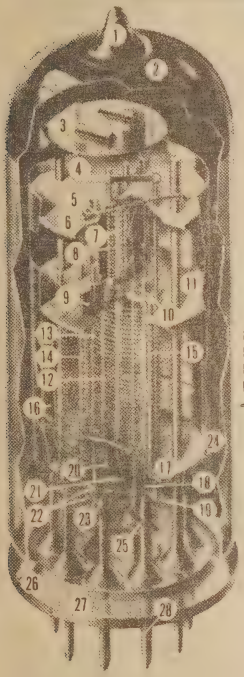
The glass bulb slips down over the electrode structure to seat over a ridge on the base assembly, which is filled with a special cement. This becomes plastic under a moderate temperature and cements the bulb in place. The bulb is exhausted and sealed at the top in the usual manner for miniature valves.

The "Innoval" series is suitable for all normal broadcast applications and, also at frequencies involved by FM and television services. Prices are similar to those ruling for comparable full-sized valves.

Unlimited stocks are available immediately of the 6AN7, a triode-hexode with full frequency ratings to 100Mc. Also available is the 6M5, a miniature power pentode with ratings similar to those of the well-known EL3-NG.

Other types scheduled for early production include a diode-triode, a diode pentode, an R.F. pentode, two VHF triodes and a special telephone repeater tube. The range will be extended to include all types of valve, including a rectifier as manufacturing facilities permit. The valves are being manufactured both in Eindhoven and in the Hendon (SA) factory of the Philips organisation.

Since the miniature 7-pin base is inadequate for certain types of valve, the adoption of the standard 9-pin Noval base for the complete range appears to be a very logical step. This feature, combined with the special sealing technique should make the valves a very attractive proposition for designers in the coming season.



KEY TO ILLUSTRATION

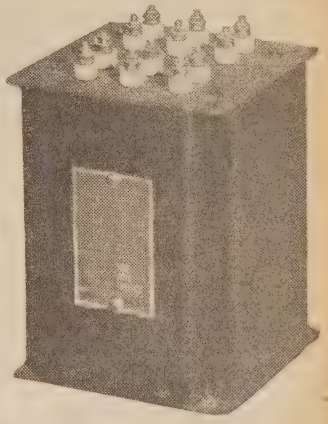
1. Sealed off exhaust tube.
2. Glass bulb.
3. Getter holder.
4. Connection between triode grid and hexode grid No. 3 (injection grid).
5. Connection between triode plate and base pin.
6. Top mica.
7. Common cathode for triode and hexode sections.
8. Triode grid.
9. Triode plate.
10. Connection between hexode grids Nos. 2 and 4.
11. Centre mica.
12. Hexode grid No. 1 (Signal grid).
13. Hexode grid No. 2.
14. Hexode grid No. 3.
15. Hexode grid No. 4.
16. Hexode plate.
17. Bottom mica.
18. Connection between hexode grids Nos. 2 and 4 and base pin.
19. Connection between hexode grid No. 3 and base pin.
20. Connection between hexode grid No. 1 and base pin.
21. Heater.
22. Connections between heater and base pin.
23. Connection between hexode plate and base pin.
24. Internal shield.
25. Connection between internal shield and base pin.
26. Glaze seal between bulb and pressed glass base.
27. Pressed glass base.
28. Silver-plated chrome iron base pin.

These two valves are available immediately from stock, likewise the sockets.

125-WATT TRANSFORMER

Ferguson's Radio are marketing a line of modulation transformers which are ideal for amateur or small commercial transmitters. Standard audio power ratings are 25, 50 and 125 watts.

The 125-watt transformer, pictured below, has a multi-tapped primary and secondary and, by suitably interconnecting the terminals, the primary load can be varied from 500 to 20,000 ohms and the secondary from 500 to 30,000 ohms, without loss of efficiency. It can therefore be used for high powered P.A. systems. A data sheet supplied with the transformer gives the necessary information.



Retail price in the sealed can is £13/16/-. A smaller 50-watt transformer, with similar tappings and finish is available for £10. In ordinary pressed covers, and with fewer tappings, the 50-watt transformer is available for £5/11/-. The standard 25 watt modulation transformer retails for £4/5/-.

Supplies of all these transformers are available on order from all Ferguson distributors.

NEW YEAR BARGAINS

COILS

R.C.S. type 162/3 I.F. Transformers. 455 K/c. Brand new. Per pair **15/-**
Postage 1/- extra.

R.C.S. 455 K/c Oscillator coil and Loop Aerial, for portable sets. New.

7/6
Postage 1/- extra.

RF METERS

Brand new, ex-disposals thermo-couple meters. 0-1 amp. 3" dia. plug-in type. As used in No. 11 transceivers.

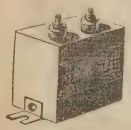
15/-
Postage 1/3 extra.

ESCUTCHEONS

Black bakelite escutcheons 3" x 3" approx. Suit R.C.S. DA7 or Efco MK17 dials.

6d
Postage 3d extra.

BLOCK CONDS.



0.25 mF. 5000V test **2/-**
Postage 1/6.
0.1 mF. 1500V Working **1/6**
Postage 1/3.

INSULATION TAPE

High grade English insulation tape 5-8" wide in 10yd. reels. Usually 1/9.

1/3
Postage 3d extra.

INSULATORS

Porcelain lead-thru insulators 3½" long. With brass rod and nuts.

2/6
Postage 3d extra.

DYNAMIC UNITS

Dynamic 'phone units in bakelite case, with rubber ear pad. Impedance 45 ohms. Ideal for use as a microphone.

5/-
Postage 6d extra.

EBONITE ROD

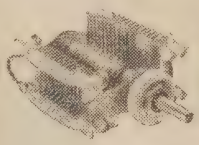
Best quality in 1ft. lengths.
3 for **1/-**
Postage 3d extra.

MORSE KEYS

Army No. 8 Morse Keys. Brand new. Fully adjustable, heavy contacts.

3/6
Postage 9d extra.

CONDENSERS



Butterfly type as used in I.F.F. sets. Cap.: approx. 40 mmF. Overall size 2" x 2½" x 2"

3/6
Postage 9d extra.

SOLDER PASTE

1lb. tins G.U.D. solder paste. While they last

2/-
includes postage within Australia.

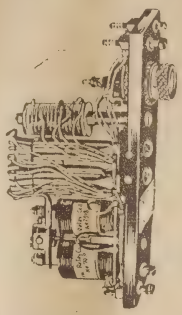
VALVES

6H6. Metal Duo-diode.
6SH7. Metal R.F. Penthode.
7193. H.F. Triode.

5/-

EF50. H.F. RF Penthode Each **10/-**
Postage 1/- extra.

RELAY PANELS



Consists of full wave 100 m/A, 48 volt copper oxide rectifier. Sensitive relay. 2 Jacks. Indicator lamp.

5/-
Postage 1/3 extra.

MIDGET CONDS.

British Wavemaster 100 mmF. midget condensers. Brand new in cartons. Ceramic insulation and brass plates. A genuine bargain.

5/-
Postage 6d extra.

RELAYS

Relays as used in American I.F.F. equipment. Various models all useful. As new.

5/-
Postage 6d extra.

CONDENSERS

Cyldon high grade British transmitter condensers. Ceramic insulation, polished aluminium plates. Capacity 200 mmF. Easily converted to split stator.

20/-
Postage 1/6 extra.

VIBRATORS

Heavy duty gas filled vibrators. 12 volt type fitted to octal base. Soiled but new.

5/-
Postage 1/- extra.

PHONES

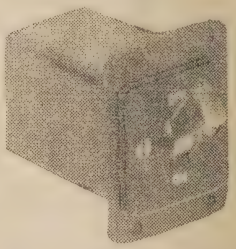
Dynamic phones, complete with band, cord and ear pads. Impedance 90 ohms per pair.

12/6
Postage 1/6 extra.

WAFER SWITCHES

Yaxley. 3 bank, 3 pole, 3 position **5/-**
Yaxley. Single bank, 6 pole, 2 position **3/6**
Oak. Single bank, 6 pole, 2 position **2/-**
Postage 3d each extra.

SWITCHES



Aircraft low tension switches. Moulded bakelite construction with plated lever. Positive action.

9d
Postage 3d extra.
Or 3 for 2/- plus 9d postage.

SUNDRIES

7-way shielded cables 3' long . fitted with lugs **6d**
VCR 139A C.R. Tubes. New **40/-**
Heavy duty twin shielded cable, per yard **6d**
Small 12v Selenium rectifiers **6d**
Plus postage.

PRICE'S RADIO

5 & 6 Angel Place - - - SYDNEY

NEW YEAR BARGAINS

TRIMMERS

Philips concentric trimmer condensers. Capacity approx.: 10-125 mmF. Size 7-8" dia.; 1¾" long. Mounted in bakelite case.

6d

Postage 3d extra.
Or 5/- per doz. plus 1/- postage.

TRIPODS

Heavy duty tripods, as used with helio. Used but in good order.

10/-

plus Freight.

SWITCHES

High grade English toggle switches. 240v at 1 amp. Highly plated. Worth 3/6.

2/6

Postage 3d extra.

PHONES

Army low resistance headphones. With band & cord. Used but in good order.

5/-

Postage 1/- extra.

AIR TRIMMER

Preset air trimmers. Ceramic insulation with plated plates. Capacity approx. 30 mmF.

2/-

Postage 3d extra.

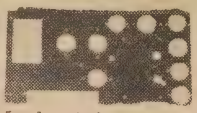
CONDENSERS

Transmitting condensers as used in "Command" sets. Capacity 100 mmF. Size 3 3-8" x 2 3-8" x 2".

7/6

Postage 1/- extra.

CHASSIS



5 valve steel chassis for mantel sets. Size 12" x 6" x 1½".

2/-

Postage 2/- extra.

CONDENSERS

Mica condensers. Brand new 0.01 mF. worth over 4/-, a bargain at

1/6

Postage 2d extra.

WINDINGS

Replacement windings for vibrators.
Transformers:—
6v to 150v at 20 mA.
Core 7-8" x ¾" x 1 3-8".
6v to 130v at 30 mA.
Core 1" x 1" x 1½".
4v for Radiola.
Core 1" x 1" x 1½".

3/6

Chokes. 30H at 20 mA.

2/-

Postage 6d each extra

METERS

Brand new meters, ex-disposals. 0-1 mA, flush mounting with 0-1 scale. Resistance 100 ohms.

37/6

0-100 mA, 3" flush mounting.

30/-

Postage 1/- extra.

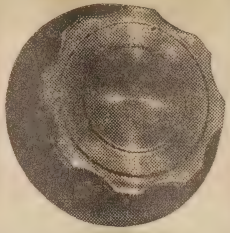
MORSE SET

An ideal practice set, consists of No. 8 Morse key, double adjustable buzzer, 4 terminals, battery strap all mounted on wood base. (No battery included).

5/-

Postage 2/- extra.

KNOBS

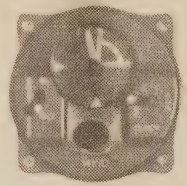


Marquis MIK1F Instrument knobs. High grade black bakelite. Dia. 3" for ¼" spindle.

3/6

Postage 6d extra.

CONTACTORS



TYPE BC-60BA.
A precision timer with jewelled 48-hour movement. Can be run continuously or for 1 minute intervals. Ideal for photographic work.

12/6

Postage 2/- extra.

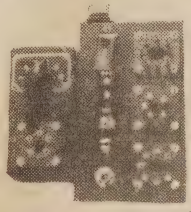
TRANSFORMERS

Shop-soiled Rola speaker transformers. For battery valves only.

2/-

Postage 9d extra.

CONTROL BOX

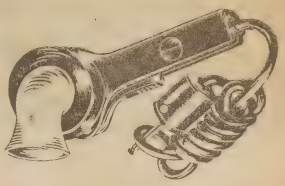


Control boxes for use with BC966A, contains two toggle switches, jack, one each 5 & 7 pin sockets male and female, 6 position rotary switch.

5/-

Postage 1/6 extra.

MICROPHONES



New carbon microphones either No. 3 with rubber mouth-piece or Navy type with flat mouth-piece.

7/6

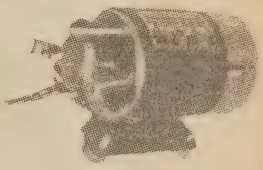
Postage 1/3 extra.

SUNDRIES

5-pin Steatite Sockets . .	2/-
12v Aldis Bulbs	1/-
0.1 meg. Bradley Pots . .	1/6
4-pin H.D. Connectors . .	2/-
No. 3 Microphone Cables .	3d
6 ohm Rheostats	1/6

Plus Postage.

GENEMOTORS



As used in the American IFF Sets. 18 volts input. 450 volts at 60 mA output. Ideal for portable transmitters, amplifiers, etc. Can be used as motors to drive small tools. The shaft is extended at both ends.

30/-

Postage 2/- extra.

SUNDRIES

3-16" Ebonite tubing, per ft.	3d
Small chassis for portables	1/-
G.R. type knobs 1" dia. . .	9d
4 mF. 750v Working Conds.	10/-
Carbon Pile Voltage Regulators for 18 volts	1/-

Plus Postage.

PRICE'S RADIO

5 & 6 Angel Place - - - SYDNEY

A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

CRYSTAL CIRCUITS FROM U.S. READER

One of our overseas readers is specially interested in crystal sets. He is Mr. J. Amrose of R-4 Hungary Road, Richmond, Vo.

SPEAKING of the set, Mr. Amrose says:

"The volume and selectivity produced by this set is surprising. It separates stations beautifully, and has high sensitivity. Here, in the US, the average day-time receiving range is 25 to 50 miles; at night, it often brings in stations two to three hundred miles away. Many of our stations here use 50,000 watts power, so such reception is not unusual here.

"Many people think crystal radio is dead; but recent statistics here show more than three million crystal sets are in use in the US, even though electric radios are rather cheap now, and within the reach of everyone.

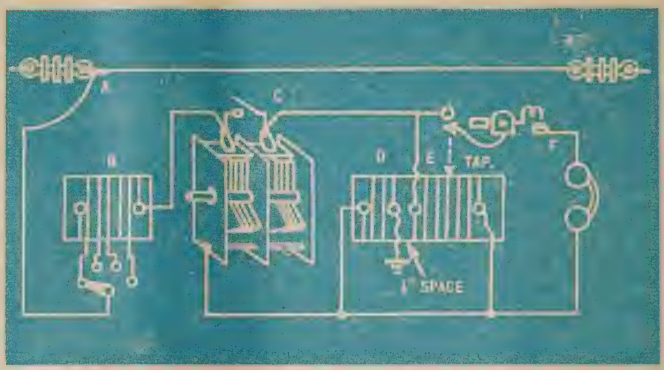
"I look upon the above circuit as a particularly efficient one and the following data will be useful for anyone who wants to build it."

A—AERIAL. Use 100 feet of No. 7/22 copper wire; erect it 30 feet above ground. Place glass insulators on both ends of aerial and use insulated window strip for lead-in; keep aerial tight.

B—LOADING COIL. Wind 75 turns of No. 24 cotton-covered or enamelled wire on a 3in diameter, 2½in. long Bakelite form. Tap (make a loop) every 5th turn; then run each tap connection to switch points on Bakelite or Masonite panel. This coil increases volume and sensitivity.

C—CONDENSER. Any standard 2-gang condenser of 350 to 450 mmfd. size may be used. Hook a switch between the two stators at "C." Closing this switch gives loudest volume; opening it gives best selectivity.

D—COUPLER COIL — Primary Winding. Wind 15 turns of No. 24 cotton or enamelled wire on 3in diameter Bakelite form, about 4 inches long.



Favorite circuit of Mr. Ambrose uses a 2-gang tuning condenser.

E—COUPLER COIL—Secondary. Leave 1-8 inch space between this winding and the primary. Wind 90 turns of same size wire, as shown at "E". For extra selectivity, make a tap at 45th turn, if you live in a large city with many strong stations nearby. Switch lever and switch point may be used to switch to this tap, if made.

F—CRYSTAL. Loudest, most stable results are secured with new "1N34" Germanium diode. Of the ADJUSTABLE type crystals, the Meter-tested Steel Galena is generally best. With this, use an extra thin catwhisker—file point needle sharp. Best advise is: TRY ALL. Then choose best performing crystal in your location.

G—GROUND. Use as many grounds as possible. Pipe leading to the well makes best ground. In cities, use waterpipe; never gas-pipes. File pipe shiny clean, then attach wire with ground clamp for loudest volume. Sink extra grounds 6ft. deep in wet earth; separate widely.

PHONES. Buy the best phones you can afford; the finest set is worthless with poor phones. A good headset often gives twice as much volume as a poor one. For loudest volume and sensitivity choose phones of 2000 or 3000 ohms.

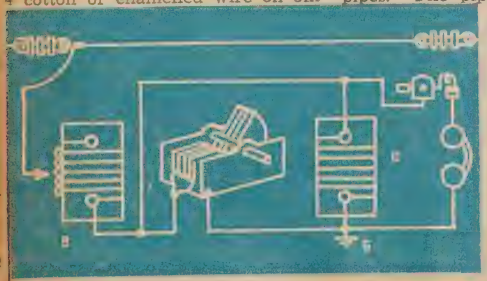
USING LOUDSPEAKERS ON CRYSTAL SETS. If volume in your phones is loud, so music can be heard plainly five or more feet away, then you can use a speaker satisfactorily.

FINAL NOTES. In crystal set building, use only good parts if you want the best performing set. Link parts together with insulated hook-up wire; solder all possible connections. Space parts well, mount on a large Masonite, Bakelite or plastic panel. Avoid wood: it absorbs moisture, causes losses, poor volume. Mount coils at right angles, unless otherwise stated. Keep wire leads short. Keep aerial at least 3ft away from tin roof. The highest aerial gives loudest volume.

If the above circuit is too complicated for beginners, they can try out the simpler one which I like to call "Old Stand-By."

Here is the constructional data.

Use aerial 100ft long, 7/22 wire. Coil "B" and "D" are each 3in dia., 2½in long with 80 turns of No. 24 DCC wire on each form. Coil "B" is tapped every 5th turn to improve selectivity. Coil "D" is untapped. Condenser is .00035 mfd. Crystal detector is adjustable galena. Ground goes to waterpipe.



☆

This second circuit is easier and cheaper to build. Another one for crystal set fans to try out!

AMATEURS—DISPOSALS—EXPERIMENTERS

STOP!

READ ON!

Genemotors with protruding Shafts at each end which with slight alteration will operate on 240 volts A.C. Excellent for Workshop Fans, etc. Conversion Sheet supplied with each motor, conversion takes only 15 minutes.

30/- postage & packing 3/6 extra.

Inter-Com. Cases

Cabinet and Chassis with sloping front Panel. Partly built but unpainted.

15/- F.O.R.

Tripods

Army type folding Tripods used with Lucas Signalling Lamps etc. Excellent as a Camera stand.

12/6 F.O.R.

Valves

EF50 complete with Ceramic Socket.

12/6 postage 1/-.

VT225 Transmitting type used in the Crossley Transceiver.

7/6 postage 1/6.

834 Transmitting type triode. Suitable for H.P. use one 144 M/C.

19/6 postage 2/-.

Lamps

12 volt small bayonet cap frosted lamps.

5/- per dozen. Post free.

Portable Masts

Portable Dural Masts in 3ft. screw - together sections, diameter ¾ inch. Minimum quantity for mail order, 6.

3/- per section F.O.R.

AT LAST!

A Genemotor that will operate efficiently on 6 volts. Made to operate on 9 volts, these Genemotors have an output of 230 volts at 60 m.a. when operated on 6 volts. Perfect for use with portable amplifiers, Rigs, etc.

50/- postage & packing 3/6 extra.

Multimeter

A Compact and Robust Universal Multimeter manufactured by Robinson Electronic Laboratories, this instrument is a "must" for every experimenter at a price to suit your pocket, an instrument to be proud of.

Ranges as follows:—

D.C. VOLTS — 0-10, 0-50, 0-250, 0-500, 0-1000.

A.C. VOLTS—Same as above.

D.C. CURRENT — 0-1, 0-5, 0-50, 0-500 milliamps.

OHMS RANGES — 0-5000, 0-500,000.

£7/0/0 postage & packing 6/- extra.

SPECIAL!

966a I.F.F. SETS

Top section only, less relays, complete with case, contains the following parts:—

1 complete 3 valve H.F. Oscillator using 2-7193 valves as oscillators and 1 6H6 valve as a rectifier for Radiation Meter. Frequency approx. 200 m/c.

ALSO 1 2 Valve H.F. Oscillator similar to the above but using only 1 7193 valve in the Oscillator section. Both units suitable for conversion to 144 m/c. Many other parts for the amateur, contains 12 Valves in all as follows:—

6 6SH7, 3 6H6, 3 7193 H.F. Triodes.

Price 40/-

Transceiver

No. 11 Transceiver Chassis complete with all Valves as follows:—

2-1C7G, 2-1M5G, 4-1K7G, 1-807.

£5/10/- F.O.R.

• Small Parts List

Carbon Microphone Transformers. **4/-** post free.

Combination Buzzer & Microphone Transformer. **4/-** post free.

Isolante Terminal Strips. 50 for **4/-** post free.

26 pin Plug & Socket, silver plated pins. **5/6** post free.

Therm-amp Meters Flush Mounting 2 inch. **15/-** post free.

P.M.G. Respirator type Microphones. **4/-** post free.

FS6 Vibrator Cartridges (new) **10/-** post free.

Neutralising Condensers, Vernier Movement. **4/-** post free.

Available also at—

No. 5 ROYAL ARCADE, SYDNEY

PARAGON RADIO

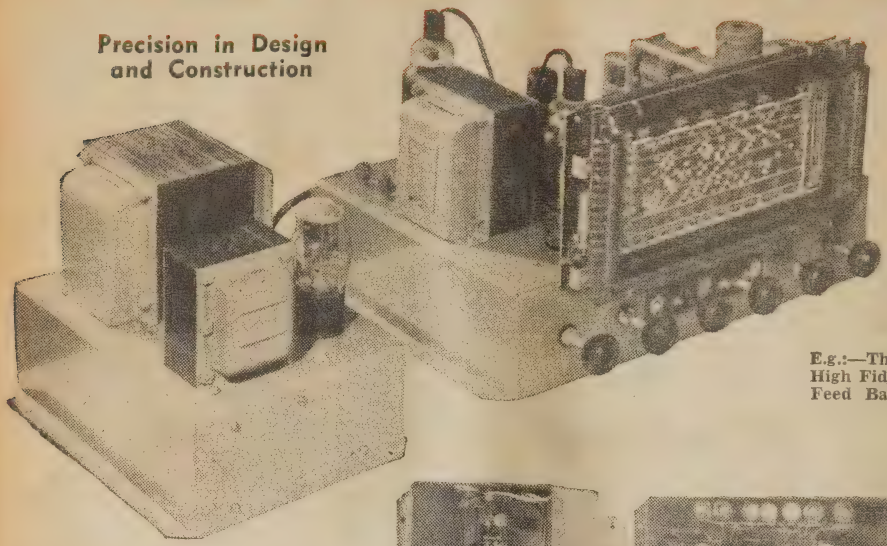
Address all mail to:—

Box 14, P.O. Haberfield, N.S.W.

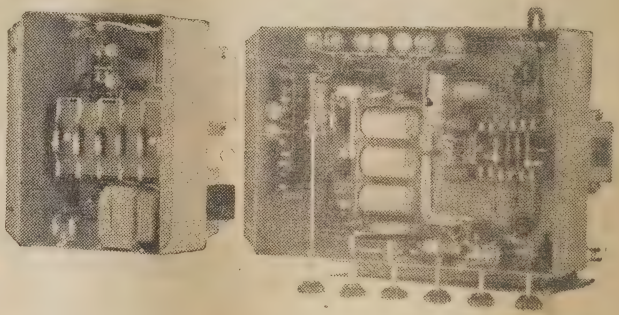
RED LINE MATCHED TRANSFORMER KITS

Precision in Design and Construction

for all classes of Electronic Equipment



E.g.:—The Williamson High Fidelity Negative Feed Back Amplifier.



Transform Your Transformer Problem

Your problem will be "transformed" from a headache to a craftsman-built component when you consult Red Line Equipment Pty. Ltd.

"RED LINE" are Specialists in the design of Transformers and Chokes to individual requirements.

A GUARANTEE

OF DEPENDABILITY

- ★ Power Transformers.
- ★ High Tension Plate Transformers.
- ★ Low Tension Filament Supplies*.
- ★ Output Transformers.
- ★ Class B Driver Transformers.
- ★ Multi Impedance Modulation Transformers.
- ★ Heavy Duty Power Supplies.
- ★ Swinging and Smoothing Chokes.
- ★ Wide Range Audio Equipment.
- ★ Frequency Dividing Networks.

*Insulated for High Voltage if required.

RED LINE EQUIPMENT PTY. LTD.

WORKSHOP: 2 Coates Lane, Melbourne (Central 4773).
CITY OFFICE: 157 Elizabeth St., Melb. (MU6895, 3 lines).

Veall's Electrical & Radio Pty. Ltd.
Arthur J. Veall Pty. Ltd.

Homecrafts Pty. Ltd.
Radio Parts Pty. Ltd.

NEW SOUTH WALES:
U.R.D. Pty. Ltd.
Homecrafts Ltd.

QUEENSLAND:
B. Martin Pty. Ltd.
A. E. Harrold.

VICTORIAN DISTRIBUTORS:
Howard Radio Ltd.
A. G. Healing Ltd.

INTERSTATE DISTRIBUTORS:
Denradio Industries (Maryborough).
J. Michelmore & Co. (Mackay).

Healings Pty. Ltd.
Motor Spares Ltd.

Warburton Franki Ltd.
Lawrence & Hanson Ltd.

SOUTH AUST.:
Gerard & Goodman Ltd.
Newton McLaren Ltd.
Unbehaun & Johnstone Ltd.

Radio Wholesalers:
TASMANIA:
Lawrence & Hanson Ltd.
Noyes Bros. (Aust.) Ltd.

U.S. LONG DISTANCE PATROL BOMBER

NEPTUNE aircraft can take off and land on carriers, and by using rocket-assisting take-off or catapult launching, they could carry fuel for very long-range flights. The US Navy apparently hoped to use the Lockheed Neptune as proof that the Air Force need not do all the strategic bombing that may be called for in any future war.

A year or so after the end of the Pacific War a P2V plane set up a long-distance non-stop record of 11,237 miles by flying from Perth (Western Australia) to Colombus (Ohio). On that occasion it took off, under Jato power, with a load of just over 38 tons—the greatest weight ever carried by a two-engined aircraft.

First deliveries of the P2V were made in December, 1945. Principal versions are:

P2V-1, with two Wright R-3350-8 motors driving Hamilton Standard four-blade airscrews; short nose with two .5in machine-guns; dorsal and tail turrets, each with two .5in guns; and

P2V-2 SPECIFICATIONS

P2V-2, powered by two Wright R-3350-24W motors, with increased take-off rating with water injection, driving Hamilton Standard three-blade airscrews, with paddle blades; longer nose with additional search and tactical radar gear; six 20 mm. pilot-fired cannon in nose; dorsal turret armed with two .5in machine-guns and tail turret with two 20 mm. cannon.

In the P2V-1, alcohol de-icing is used. In the P2V-2 electric de-icing equipment is fitted with combustion type heaters for wing and tail de-icing.

Details of other versions are restricted. It has been revealed, however, that the P2V-4 is powered by Wright R-3350 compounded motors.

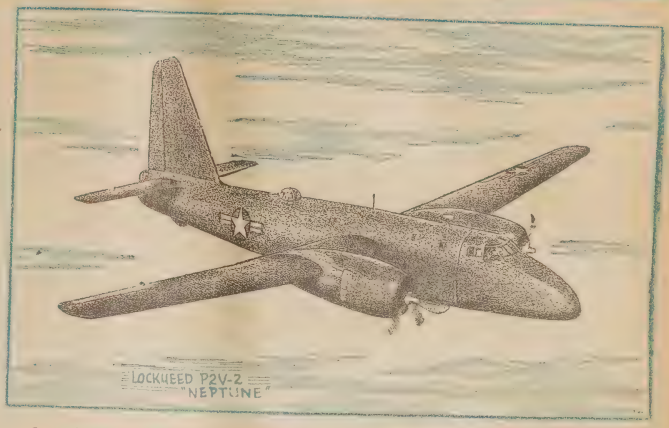
A crew of seven is carried in the Neptune. These consist of pilot, co-pilot, navigator/bombardier, radar operator and two gunners.

All crew positions are armored. There is galley and sleeping accommodation.

A mid-wing monoplane, the Neptune features wings of constant-chord centre section and tapering outer wings. All-metal structure, with metal covering, is used throughout. Split trailing edge flaps are between ailerons and fuselage, the rear portion of each nacelle moving with the flaps.

A single tail fin and rudder is fitted.

Landing gear is of the fully-retracting tricycle type, the main wheels folding forward into the engine nacelles and being fitted with hydraulic brakes.



Capable of flights of 12,000 miles or more, the US Navy's two-motored bomber Lockheed P2-V2 "Neptune" has been one of the aircraft which helped to awaken discussion as to the respective roles of the US Air Force and US Navy. It has been the Navy's "answer" to the Air Force's bombing giants such as the B29 and B36.

Comprehensive electronic and radar equipment is carried. It includes Loran equipment, search radar and a radar bomb-release system.

Empty weight of the Neptune is 32,910lb, and maximum loaded take-off weight 58,000lb. Wing loading is 58lb to the square foot and power loading (at maximum) 16.1lb to the horsepower.

Top speed is over 300 miles an hour and cruising speed 170 miles an hour. Takeoff and landing runs are 466 yards. Service ceiling is 23,200ft.

Main dimensions are: Wing span 100ft, and length 77ft 11in.

A Top Cut Filter for Voice Coil

(Continued from Page 41)

the speaker itself has a limited top response.

It so happeis that the constants for a 15 ohm circuit are not unwieldy and, using 200-volt paper condensers, we were able to fit the whole thing comfortably into a box measuring 6in. x 6in. x 5in.

For lower impedance circuits, however, the inductance values have to be proportionately reduced and the capacitance values increased so that, even for an 8 ohm circuit, the condenser values would be 8, 4, 2 mfd., &c. Since electrolytic condensers could scarcely be considered, an 8 ohm filter is about the lowest impedance which could be regarded as practical. While an 8 ohm filter might be useable with a 4-ohm coil, the outlook for a 2-ohm speaker is poor, with this type of filter anyway.

Another point concerns the series resistance of the coils, which constitutes an insertion loss. In the 15 ohm filter specified, the resistance is less than on ohm and the insertion loss is so small as not to be audible when the filter is switched in and out of circuit.

The same 1 ohm resistance in a 2.0 voice coil circuit would introduce a very noticeable loss.

We did not have opportunity to build up an 8 ohm filter but, as already stated, it would only be necessary to double the condenser values and half the inductances. According to standard formulae and wire tables, the coils would need respectively 110 and 80 turns of either 17 B & S enamel or 18 SWG.

Note that the switching arrangement allows the filter to be cut right out of circuit on the "open" position, which may be a handy feature for reference purposes.

THE Autoblast, a new British crop sprayer, blows insecticides where they are needed. Carried by the 100 mph blast, atomised droplets of "bug killer" are hurled out and up in a 40-foot arc and cover all sides of crops. The pneumatic-tyred unit is pushed by a small farm tractor, the whole outfit being operated by one man.

MIXING FUEL FOR MODEL AIRCRAFT

We have covered in turn the model engine itself, how to operate it, and now finally how to fuel it—not fool it! If you follow the text of this article I feel sure you will learn something of fuel mixtures and their application and as a consequence secure better running from your model motors.

by Jack Finneran

THE best fuel you can use in your model engine is generally speaking the one recomended by the engine's manufacture. However, some manufacturers consider that sweet reliable running with reasonable power output is the main requisite of engine performance, and choose a rather docile mixture for use with their engines.

This attitude is to be commended as it not only makes for reliability and easy starting, but also adds years of life to an engine, and taken by and large, it will be found that the power developed is sufficient for all practical purposes.

Quite a number of fluids can be used successfully to blend suitable fuels for model engines of the two-stroke variety with which we are mainly concerned here.

SPARK TYPES

Firstly we will deal with the gasoline type spark ignition engine, then Glow Plug engine and finally diesel engine fuel mixtures.

At this juncture I feel I should issue a double-barrelled warning to all who would mix their own fuel concoctions. Remember you are mixing a fuel for the two-stroke type of engine and must of necessity add sufficient suitable oil for lubrication purposes. This is vital to the safety of your engines.

Another and infinitely more important aspect has to do with your own safety, as the following sentences will show.

Many of the basic materials and additives used to mix fuels are of a highly volatile and low flash point character. Do not prepare fuel indoors due to the possible accumulation of fumes which are toxic. Don't smoke, as the fumes form an explosive mixture which is very easily ignited.

LUBRICATION

Firstly let us deal with the lubrication problem of a fuel, which problem is usually that of heat caused by the high revs of small motors and the fact that air cooling is used. Well, as you are probably aware, full scale practice is to use heavy mineral oil for general purposes, and for extreme conditions, the racing grades of castor oil.

If we abide by this practice we shan't have any troubles due to faulty lubrication. In point of fact I would seriously suggest that you always use castor oil as your lubricant, provided, of course, that it is miscible with the other ingredients of the fuel.

If, however, you find it does not mix readily you will usually find that a mineral oil of SAE 70 rating will be satisfactory.

Don't on any account take notice of "engineering friends" who may suggest the use of machine or bicycle oil or other such light oils. These may cause irreparable damage if used. These remarks on lubrication apply equally to gasoline or diesel engines and should not be deviated from unless the manufacture of your engine states otherwise.

DIESEL FUEL

Now the basic fuels for your diesel engines are likely to be kerosene, dieselene or ether.

Mostly you will find that a combination of ether with either kerosene or dieselene is used, although one manufacturer that I know of uses mainly ether as the complete base fuel. Those who use ether in combination do so mainly as the igniter, because it is highly volatile and of extremely low flash point and so readily ignited under pressure by the diesel engine.

Power developed by the fuel is usually due to the kerosene or dieselene fraction which slows up the combustion rate of the ether and so tends to eliminate that knocking sound which reduces power output. Improved performance from most diesel fuels can be had by the addition of from one to two per cent of amyl nitrate. However, if you use this chemical, do so with care, as it can increase one's pulse rate to a dangerous degree.

The following are very good standard diesel fuel proportions:

One measure of diesel fuel oil (dieselene).

One measure of chemically pure ether.

One measure of SAE 70 mineral oil.

This mixture is very versatile and will operate to perfection with most diesel engines. You may find you have to use a slightly higher compression sitting.

One measure kerosene.

One measure chemically pure ether.

One measure racing grade castor oil.

This fuel is quite satisfactory in most respects, and the kerosene is rather more readily obtainable than dieselene.

One measure SAE 20 mineral oil.

Three measures ether.

This is a fuel mixture which is quite commonly used with fixed compression diesels, and there is quite a possibility that you will have to juggle proportions if the motor is at all worn.

One more fuel for diesel use which I must mention is the very excellent proprietary line called "Mills" Fuel, which can be obtained at most model supply shops.

Now for the basic ingredients used in our spark ignition and Glow Plug engines. Here the old standby petrol is well to the fore, and for very good reasons. The suitability of petrol as a basic fuel goes without saying, as it were, when one just looks around and sees the cars, bikes and trucks which run successfully on it.

PETROL

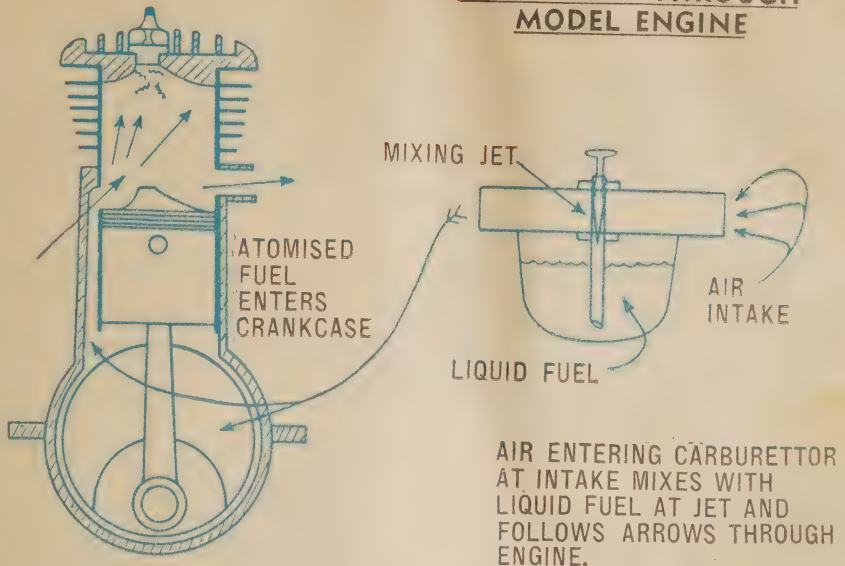
Petrol (one of those things money can't buy without a ration ticket) is a clear fluid reasonably volatile with fairly high flash point, and the ability to burn in a controlled state of combustion when used in engines. It has a very wide mixture range from rich to lean, and develops quite an amount of power when used in our small engines. Until just lately, with the advent of the Glow Plug motor, it has been the most popular base fuel for use in miniature motors.

Methanol (methyl alcohol) is a wood distilled alcohol which is fast becoming the most popular base for model fuels, because it is rather more suited to the requirements of the Glow Plug engine, and is capable of higher output with spark ignition motors also.

As the general tendency today is towards greater revs., there is a tendency for motor to overheat on petrol fuels, whereas the cooler-burning Methanol keeps engine temperatures to a safe level. Methanol is a dangerous poison, and its fumes are highly toxic, so don't breathe it in, and do your fuel mixing with it in the open air.

There are a number of additives which may be used in conjunction with these two base fuels, which will

THE FUELLING SYSTEM OF A MODEL ENGINE


FUEL FLOW THROUGH MODEL ENGINE
MIXING JET
ATOMISED FUEL ENTERS CRANKCASE
AIR INTAKE
LIQUID FUEL
AIR ENTERING CARBURETTOR AT INTAKE MIXES WITH LIQUID FUEL AT JET AND FOLLOWS ARROWS THROUGH ENGINE.

result in increased performance from them.

Commonly used with petrol, we find Nitro-Propane, which is an ignition accelerator. In other words, it increases the burning rate of the fuel, and gives greater power output at high revs.

Nitro-Methane is the ignition accelerator in use with Methanol, and it adds greatly to the power output obtainable from most motors. More particularly is this so when the engine is being operated on Glow Plug. However, great care must be taken in the use of these nitro paraffins, as they are relatives of the nitro glycerins, and under certain circumstances can be highly dangerous, due to their explosive characteristics.

On no account must they be mixed with any other ingredients except alcohol and castor oil.

FUEL MIXTURES

The following are proportions of suitable fuel mxture for all purposes:

3 measures petrol.
1 measure SAE 70 mineral oil.

This is the standard ignition fuel reliable and easy starting, with good power output:

2 measures SAE 70 oil.
1 measure nitro-propane.
4 measures petrol.

A good petrol mixture for Glow Plug operation, not critical in use:

1 measure castor oil (Castrol R).
2½ measures Methanol.

If this mixture tends to separate, add a few drops of Amyl Acetate.

This is a really good fuel for all general purposes, suitable for either spark ignition or Glow Plug, and is frequently used for very high performance.

For the ultimate in high performance work, the fuel must be tailored to the motor, and the addition of varying quantities of Nitro-Methane is used until maximum performance is obtained.

While using the base fuel of Methanol, castor oil, and adding Nitro-Methane, due regard must be taken to keep the oil ratio to fuel at about 2½ to 3 to 1.

The following is a mixture very commonly used in the high power motors, and is mainly of value when the motor is running glow-plugged:

30 per cent castor oil.
30 per cent Nitro Methane.
40 per cent Methanol.

As a last word, don't use the high performance fuels unless your motor was designed for them, as plenty of fun can be had from the petrol and oil mixture, and the standard 2½ to 1 Methanol-castor mix.

PAINT HINT

TO make a "flat" paint of good quality, mix one part boiled linseed oil, ½ part turpentine and two parts white spirit. Dissolve in this mixture about ½ part of pale resin (parts are by volume).

Take a quantity of the above medium and grind into it about one-third of its volume of fine pigment. This will constitute the paint. If you want it to dry more glossy, dissolve more resin in the medium. It is also advisable to add a small amount of a suitable drier, such a cobalt napthenate or manganese resinate, in the medium for the purpose of speeding-up the drying of the paint.

For a black paint use "drop black" as a pigment, for white paint use white lead, or zinc white or titanium oxide. A white paint made with the two latter pigments will be non-yellowing. Cream paint is made from any white pigment to which has been added just a touch of yellow ochre. Dull red pigments are the common red iron oxides. The brighter red pigments constitute the various "lake reds" which are (normally) obtainable from pigment manufacturers. For a lavender shade you will, we think, require a cadmium maroon pigment, with or without an admixture of pale cobalt blue, but we fear that you will not be able to obtain these pigments at the present time.

TO hold a string of pearls tightly together, restring them on nylon fishing line. If the string is stretched, the nylon will return to its original shape within a short time. At room temperature, the line is firm so that a needle is not required.

GENUINE RADIO CLEARANCE

BENDIX RADIO COMPASS RECEIVERS TYPE M.N.-26-C

12 Valve 3 Band 150 Kc to 1500 Kc. Ideal for conversion to home or car Radio. BRAND NEW.

£15/-/-

Freight Forward

No. 11 TRANSMITTER—RECEIVERS

4.2—7.5 M/cs. Valves 1—807, 2—1C7 2—1M5, 4—1K7. Complete with valves, leads and power pack.

£12/10/-

Freight Forward

TRANSMITTER—RECEIVERS TYPE 101

Excellent condition. Ideal for fishing-boats or yachts, etc. Complete with Power Pack, Valves and Leads. Frequency 4.2 to 6.6 megacycles. Valves 2—1C7, 2—1K7, 4—1K5.

£10/-/-

Freight Forward

TYPE R3109 H.F., I.F.F. RECEIVERS

8 valves. 2—EA50, 2—VR135, 4—VR65A. 24 volt input—480 volts, 40 MA Motor Generator. Condensers, Resistors and many useful parts. CONDITION GOOD. With Valves.

£2/15/-

Freight Forward

WESTON ELECTRIC V.H.F. 4 VALVE RECEIVERS

Midget type. Brand New. 234 to 258 M/cs. Valves, 3—954, 1—955. Super Regenerative Receiver.

£4/10/-

Freight Forward

TYPE 1133 TRANSMITTER—RECEIVER

English equivalent Bendix SCR 522. Complete with Valves. 1—VT61, 3—VT52, 2—VT60, 2—VR55, 2—VR53, 2—VR56, 1—VR54, 1—VS110, 2—VR57.

£8/10/-

Freight Forward

"Gibson Girl"

LIFEBOAT EMERGENCY TRANSMITTER, 500 K.C.

Hand Cranked Generator (300 volt/25 M.A —28 volt/160 M.A.). Braided Phosphor Bronze Aerial Wire. Valves, 1—12SC7, 1—12A6. An ideal distress equipment for small craft.

£4/17/6

Freight Forward

TRANSMITTER—RECEIVERS TYPE 3505

(Approx. 300 M/c.). Complete with 14 Valves. 24 volt motor-driven switch unit. Valves, 1—5Z4G, 1—VU120, 1—VR54, 2—VR65, 2—CV63, 1—6V6, 1—VR116, 2—VR136, 1—VR137, 1—CV66, 1—CV73.

£12/10/-

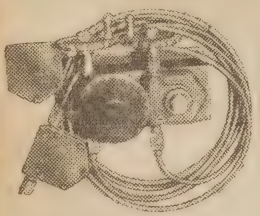
Freight Forward

TRANSMITTER—RECEIVER TYPE RT 7/APNI

Complete with generator and 14 Valves. 1—VR150, 4—12SH7, 3—12SJ7, 2—12H6, 2—955, 2—9004.

£10/10/-

Freight Forward



WIRELESS REMOTE CONTROLS

Containing two Bowden control cables and 360 deg slow motion diel. Ideal for car radios, etc.

£1/-/-

ENGLISH THROAT MICROPHONES

Magnetic type, high output, may also be used as contact microphones on musical instruments or adapted for use as a pick-up for electric guitar. Comprises two microphone units which may be used separately. Brand new.

12/6

Postage and Packing: Vic., 9d; N.S.W., S.A., Tas. 1/-; Qld., W.A., N.T., 1/3.

PROPELLER FEATHERING MOTORS

24 volt AC-DC, with 600 lb. Hydraulic Pump .. **£3/15/-**

Freight Forward

VALVES

1K7G	12/6
1M5G	12/6
1K5B	7/6
6K7	9/6
RK73	10/-
1A5	9/6
6V6GT	12/6
6SH7	9/6
5U4	12/6
AR21	9/6
RKR73	10/-
VU72	7/6
6H6GT	9/6

Add 1/- for Postage and Packing.

"CADET" LOUD-SPEAKERS

6" Permag. Without transformer, 15/-. With 1500 transformer, £1.

Postage and Packing: Vic., 1/6; N.S.W., S.A., Tas., 2/6; Qld., W.A., N.T., 3/6.

HYGROMETER

For temperature and humidity reading—should be in every home.

Price **19/6**

Postage and Packing: Vic., 1/6;

N.S.W., S.A., Tas., 2/-; W.A., Q'ld., N.T., 2/6.

COMPASS TYPE P.8. 5½in. dia. x 2½in. deep. Accurate navigational compass, aircraft type, liquid filled; complete in carrying case. **Brand New.**

PRICE 45/-

Postage and Packing, Vic., 2/-; N.S.W., Tas., S.A., 3/6; Qld., W.A., N.T., 5/-.

TELEPHONE HAND-SETS

Standard P.M.G. Type, complete with cord and 4-pin Plug Brand new 37/6

Postage and Packing, 2/6, All States.

"ENSIGN" CAMERA FLOOD LAMPS

230 Volt 1000 C.P. E.S. Fitting.

30/- per doz.

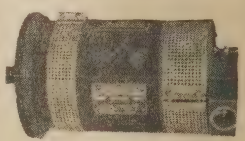
Postage and Packing 3/6 All States

AERIAL COUPLING UNITS: (No. 11 set)

Containing 0-300 M/a R.F. Meter, 3 gang .0005 m.f.d., variable condenser, resistors and variometer, etc.

Price **27/6**

Freight Forward



BATTERY CHARGING GENERATORS

All generators checked and tested before despatch.

	£	s	d
24 Volt 1500 Watt	12	10	0
12 Volt 500 Watt	10	10	0
12 Volt Cutouts	0	10	6

Freight Forward

All goods marked "Freight Forward." Freight to be paid by customer on delivery.

WALTHAM TRADING CO.

393 Flinders St., Melbourne. Phone MB2701.

MAIL ORDERS PROMPTLY DESPATCHED.

WRITE FOR OUR LATEST BARGAIN CATALOGUE

SERVICEMAN WHO TELLS

(Continued from Page 64).

formers had a very broad peak, although I was inclined to discount this at first because it is of a special pattern. One winding is tuned in the normal way, but the other is untuned, the two windings being tightly coupled. However, a routine check with a multimeter revealed that the resistance of one winding was much higher than the other, and tended to give an uncertain reading. I compared it with the windings on the other transformer, and came to the conclusion that all was not well. It seemed as though a spot of corrosion might have been developing somewhere inside.

Very fortunately, for unfortunate people like me, the manufacturer of the set in question maintains a good service department, and I was able to verify that the transformer was apparently faulty and that a bobbin carrying replacement windings was obtainable.

After that, it was merely a routine job of stripping out the transformer and removing the original bobbins, taking care, of course, to note which wires went to which lugs. The new bobbins were installed, the transformer replaced, the set re-aligned and that was that.

FAULTY CONTROL

Just to conclude on a happy little domestic note, my own radio is giving trouble again and it fair makes me mad! All is well provided that we leave the volume control alone, but the moment an attempt is made to turn it up a little and drown the noise of Christmas trumpets, the set yells its head off. One then has to wiggle the knob until it shuts up and the volume is usually even then lower than it was before.

I know what is wrong—or at least I think I do. Something has apparently come adrift around the sliding contact, allowing it to short intermittently across to the hot audio terminal. Thus, every time the control is disturbed, the set turns itself full on.

The easiest cure for this is to install a new potentiometer, although a bit of careful work with the pliers or punch on one of the assembly rivets may obviate the trouble.

Alternatively, it may just be a case of hardened grease on the resistance strip or between the centre lug and the rotating arm. In this case, the circuit will be partially insulated most times by a film of grease, which gives way under movement of the control and allows the thing to operate normally. A few drops of petrol or tri-chlor would remove the troublesome "goo."

The final possibility is that the resistance element is worn so that, at odd times, the wiper is bearing as much as anything against cardboard or bakelite—whatever it is that sundry manufacturers use.

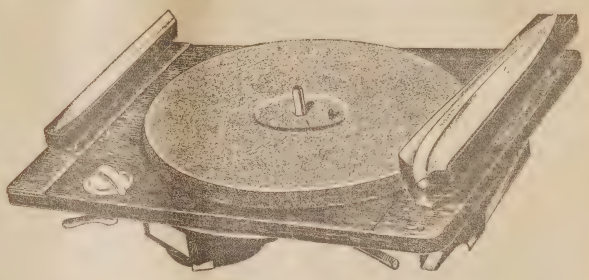
In this event, a temporary repair could be made by rubbing over the offending spots with a very soft pencil, working the surface smooth with the point of your little finger.

AMERICAN "GENERAL INDUSTIES" RECORDING HEAD AND PLAY BACK UNIT.

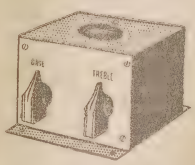
Model GI/R90—£25/-/-. Fitted with 2-speed motor, 78 and 33 1-3 R.P.M., 240 volt A.C. 50 cycle, crystal pick-up and automatic start cutting head.

DIMENSIONS: Base plate 15" wide, 11½" front to back, height above lower edge of base plate 2¾", depth below lower edge of base plate 3 7-8". Packed in individual cartons, shipping weight 17 lbs.

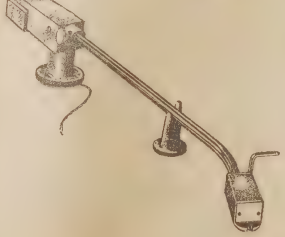
Also available as a built up unit with amplifier, mounted in carrying case, which holds 12" speaker and unit complete—£59/10/-.



"GENERAL ACOUSTICS" PHONO PICK-UP EQUALISING PRE-AMPLIFIER



This small unit can be attached to any amplifier or radiogram, and is fitted with two variable control knobs, one for bass, and the other for treble, which allows either to be accentuated, and is designed to provide compensation for standard recording characteristics. This unit obviates the necessity of an input matching transformer nd low frequency equaliser, which are normally required with a high fidelity pick-up. By adjusting the treble control, various degrees of attenuation of high frequencies can be obtained. By this means surface noise can be eliminated when worn recordings are reproduced. Leads are supplied for connecting the unit to the power supply of the amplifier or radio, together with input and output connections. When installed, the bass and treble controls can be set in the desired position, and the output from the pick-up can be held constant within plus-minus 2db from 100 c/s to the upper limit frequency, which the pick-up can reproduce. When used with the new "W.R.N." Transcription model high fidelity light-weight pick-up, the frequency response is plus-minus 2db from 100 c/s to 10,000 c/s, Domestic model to 6,000 c/s. The size of the unit is 3½" x 2½" x 3½", and weighs 17 oz. and retails at £3/17/6 including sales tax.



"W.R.N." MAGNETIC PICK-UP

High fidelity light-weight with special sapphire jewel stylus, price £15/10/- retail. Transcription model £18/-/-. Needle pressure ¾ oz., will play commercial records 500 times without wear to the record or stylus. Further particulars available on application.

Write NOW for our 1950 Catalogue.

RADIO HOUSE PTY. LTD.

296 PITT STREET, SYDNEY. 6 ROYAL ARCADE, SYDNEY.

MAKING A SIMPLE ELECTRIC MOTOR

A few pence will cover the cost of this fine little electric motor which is quite easy to make. Scrap materials are used for many of the parts. If enamelled wire is used, paste two layers of paper over the metal to ensure against short circuits. It's a good precaution in any case.

AFTER becoming acquainted with the principles of magnetism and electricity the beginner usually desires to make a piece of apparatus that will work.

The model to be described is an electro-motor, shown in Figs. 1 and 2.

It consists of an electro-magnet at the ends of which an armature, in the form of a cross, is caused to rotate. By means of a contact breaker on the armature shaft, the

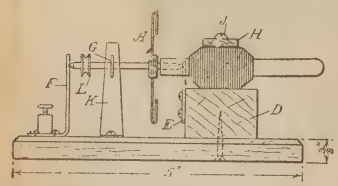


Fig. 1.—The motor in elevation.

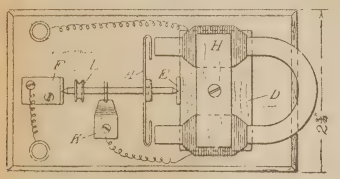


Fig. 2.—Plan view of the motor.

circuit is broken at the right moments, so that the armature revolves continuously, and at a rapid rate, while connected to a battery. The armature shaft is provided with a small pulley for driving light models.

THE ELECTRO-MAGNET

First of all, obtain a stout iron staple, such as can be purchased from an ironmonger's shop for a few pence. The staple should be about 3½in long and 1¼in wide between the limbs, so that when the points are cut off with a hack-saw the magnet will appear as shown in Fig. 4. File the ends of the magnet smooth and square.

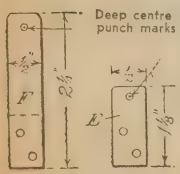


Fig. 7.—Brass strips for bearing plates.

About 12yds of No. 26 gauge cotton-covered copper wire will be required for the magnet coils, 6yds for each. Start winding the wire around one limb of the magnet in the manner indicated in Fig. 5, leaving a free end of about 6in for connecting-up purposes.

The turns of wire must be wound on as closely and evenly as possible, the first layer of turns coming to within ¼in of the end of the magnet limb. When half of the wire has been wound on for one coil, tie a piece of strong thread round the last two turns to keep the wire from unwinding.

Cross the wire over and wind in reverse direction on the other magnet limb, as indicated in Fig. 5. Tie a piece of thread round the last two turns, leaving about 6in free as before.

ARMATURE AND SPINDLE

For the armature, A, cut two strips of thick tinplate (B, Fig. 6) and round the ends with a file. In the middle of each strip drill a 3-32in hole, bend over the ends and pinch together with pliers.

The armature spindle consists of a 2in length of bright steel rod 3-32in diameter with the ends carefully pointed with a file. A piece cut from a steel knitting needle of the required diameter would make a suitable spindle.

Press the armature arms on to the spindle at a distance of ¼in from one end, and at right-angles to each other. Adjust them carefully for squareness, and then solder them together, and to the spindle.

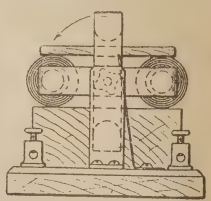


Fig. 3.—End elevation of assembly.

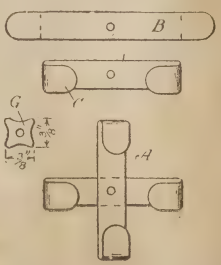


Fig. 6.—How the armature is made.

The contact-breaker G can be filed to shape from a piece of sheet brass 3-8in square, a hole being drilled in the centre a tight fit to the spindle. Round the corners carefully with a fine file and then press the contact-

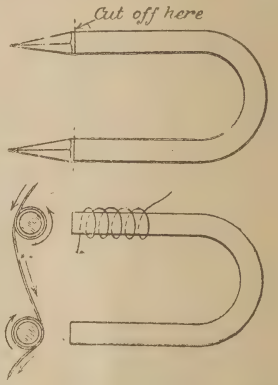


Fig. 4 and 5.—Showing how the magnet is made and wound.

breaker on to the spindle to the position shown in Fig. 1.

BASEBOARD AND BEARING PLATES

At this stage the baseboard can be prepared from a piece of planed wood 5in long, 2¾in wide and 3-8in thick. Bevel the top edge all round, as indicated in Figs. 1 and 2. A rectangular block of wood D, 2 1-8in long, 1¼in wide and 7-8in thick can now be made for supporting the magnet. Fix the block in position with two screws driven in from underneath the baseboard.

To make the bearing plates E and F, prepare a strip of thin sheet brass 3 3-8in long by ½in wide. Cut off a piece 1 1-8in long (E), and drill two holes in the lower part for fixing screws. Near the top edge make a deep centre-punch mark, as shown in Fig. 7.

Make a similar centre-punch mark near the top end of the other strip (F), and, after drilling the two holes in the lower part, bend the strip at a right-angle on the dotted line so that the centre-punch mark is on the opposite side of the strip, to the bent foot.

ASSEMBLING THE PARTS

Clamp the electro-magnet firmly in place on top of the block D by means of a strip of 1-8in wood (H), and a round-headed screw (J),

allowing about 3-8in of the magnet limbs to project beyond the face of the block D.

The two bearing plates can be screwed in position and adjusted so that the spindle runs quite freely and is parallel to the baseboard. When the spindle is revolving the bent-over parts of the armature should clear the ends of the magnet by a bare 1-16in. The magnet can be finally adjusted to bring this right by slightly turning the holding-down screw.

A strip of thin spring brass 3-8in wide and 2in long is used for the contact brush K, which should be cut to a slight taper, as in Fig. 1. Bend the bottom part to a right-angle, drill a hole in the foot and then screw it down to the baseboard in the position indicated in Figs. 1 and 2, so that it presses lightly against the rounded corners of the contact-breaker when the armature revolves.

MAKING THE CONNECTIONS

After screwing two terminals in the baseboard, proceed to connect up the wire from the magnet coils The end of the wire from one coil is clamped under the head of the screw which fixes the brush to the baseboard, the end of the wire from the other coil being screwed down under one of the terminals, as shown in Fig. 2. The other terminal is connected to one of the fixing screws of the bearing bracket F.

The motor is now ready for connecting up to the battery, which may preferably consist of a 4-volt accumulator. After giving the armature a turn to start it, it should revolve at a rapid rate if the contact-breaker is carefully adjusted so that it is just breaking contact with the brush when either of the two arms are directly opposite the ends of the magnet. Reference to Fig. 3 will make this point clear. When the correct position is found, fix the contact-breaker to the spindle with a touch of solder.

How to work out your Grid Bias

(Continued from Page 47).

only convenient method. The highest back bias voltage used in the set is subtracted from the total high tension voltage available. However, with modern high gain beam tetrodes requiring very little bias, this is not very serious.

The calculation of the value of a back bias resistor is no more difficult than for cathode bias. The only difference is that the total current of the receiver or amplifier is considered, rather than the current of an individual valve.

If, for example, it is desired to calculate the value of the back bias resistor when -12.5 volts is required for a 6V6-GT and the total current drain of the receiver is 80 mA, only the simple Ohm's Law formula is required. In this case, the resistor works out at 156.25 ohms. Valves are not designed to this small tolerance and the resistor could quite conveniently be either 150 or 175 ohms. It is always better to err on the high, rather than the low side.

TOOL BARGAINS

"Rabone" 6ft. Steel Tape, 8/6.

Sawspindle, Double-ended, complete with 6" Saw and Emery Stone, Bearings, etc. .. .. 90/-.

Sidecutters, 5" 5/6; 6" 6/6; 7" 8/6.

Snipe Nose Pliers, 5" 5/6; 6" 6/6.

Snipe Nose Pliers Ins., 5" 6/6; 6" 7/6.

Longnose Pliers, 8" 10/6.

Comb. Pliers, 5" 4/6; 6" 5/6; 7" 6/6; 8" 7/6.

Comb. Pliers Ins., 6" 8/6; 8" 9/6.

Vice Grip Pliers .. 14/6

Gordon Engl. Multigrips, 12/6.

"Bahco" Swedish Crescent Shifting Spanners, 4" 8/3; 6" 10/-; 8" 11/-; 10" 13/6; 12" 17/6.

"Carrington" Engl. Crescent Shifting Spanners. 6" 13/-; 8" 13/6; 10" 17/3; 12" 21/-; 15" 37/6.

Bedford or Gordon Chrome Van. Spanners, O.E., SAE, Whit, 53/6 per set of 7.

King Dick Ring Spanners, SAE or Whit. Per Set 103/-

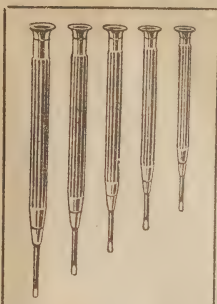
King Dick Socket Spanners, SAE. Complete with Ratchet, Brace, Universal Hinged Handle, etc. Set, 295/-.

Zircaloy Magneto Spanners, BA .. .. 3/6 ea.

Engl. Stillson Wrenches, 10" 15/6; 14" 27/6; 18" 31/-; 24" 45/- each.

American Chain Pipe Vices, each 55/-.

American Steel Tapes, 66' 77/6; 100' 98/6.



WATCHMAKER'S SCREWDRIVERS
10/6 Set of 5

SPECIAL
High Speed Drills
1/16" to 1/4"
19/6

SAE & Whitw. Stocks & Dies. Prices on Application.

Numberdrills 0-60 on Stand, 61 drills per set, 78/-.

Fractional Drills, 1/16-½ on Stand, 29 Drills per set, 85/-.

6" Jeweller Snips .. 8/6

Gilbow Tinsnips, 10" 10/6; 12" 12/6; 14" 16/6.

U.S.A. Tappet Spanners, 7-16 x 17-32, 6/- each; 5-8 x 11-16, 6/- each.

King Dick Tappet Spanners, 7-16 x ½" SAE, 9/3 each; 3-16 x 1" W, 9/3 each.

Socket and Ring Spanners, all sizes. Prices on application.

Eclipse Hacksaw Frames. Tubular, 12/6; Flat, 6/6 and 9/6 each.

Stanley ¾" Breastdrill, each 48/6.

Stanley ½" Handdrill, each 24/6.

Stanley Ratchet Brace, each 38/6.

Stanley or Record Spokeshaves, adjustable, each 10/6.

Disston - Keystone Handsaws, 28/6.

Eclipse Sawset, each 18/6

Circular Saws, cross-cut or rip, 6" 17/6; 8" 19/6.

Hard and S.W. Bits, all sizes, from 4/9 to 8/6 each.

Stanley & Record Planes, No. 4, 48/-; No. 4½, 57/6; No. 5, 62/6; No. 5½, 67/6.

6" Jeweller Snips, bent, 9/6 each.

EXTRA SPECIALS

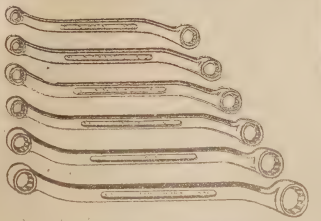
Eclipse or Vanadia Engl. Carbon Power Hacksaw Blades, 12" x 1" x 13g 10 or 14T, dozen, 7/6.

Engl. Carbon Drills, set of 3, 1-16-3-8 in Oilskin bag. Per set .. 12/6

or Grip Hand drill, ¼" Cap. Each 7/6

"Marples" Firmer Chisels. Set of 7, ¼ to 1¼, 35/- per set.

Engl. Galscutters 1/6 each.



RING SPANNERS
S.A.E. Sidchrone. Set of 6, 47/6.
Whitw. Zircaloy. Set of 4, 45/-.

Kelly's Visa Broad Hatchets, 16/6 each

"Skimma" Engl. Plasterers' Trowels, reduced from 13/6 to each 10/6.

Tyzak Tubular Bushman Saw, reduced from 28/6 to ea. 18/6.

Expansive Bits, U.S.A., ¼ to 1½" 17/6; 1½ to 3" 22/6.

W.H.S. Trowels, 13" 18/6.

American Metal-Keyhole Saw, 1/9 each.

TOOL CENTRE

585 GEORGE STREET, SYDNEY, N.S.W.

• PLEASE WRITE OR PHONE MA2225 FOR ALL THE TOOLS YOU NEED.

• THERE IS HARDLY A TOOL WE CAN'T SECURE FOR YOU.

Please Send Cheque, Money Order or P.N., Plus Postage.

SURPLUS

512 ELIZABETH ST., MELBOURNE, C.1.
PHONE: FJ5904. Just 4 doors from

We are pleased to announce sole distribution "Stratee" Opal Mine, Central Australia.

AUSTRALIA'S LUCK STONE

Marvellous Xmas Gift for England, America or Europe. All Opals cut and polished. Previously sold at £3 to £5.

6/6, 12/6, 25/- each

Oval, Round and Drops. Illustrations are 25/- size.

WATCHMAKERS AND INSTRUMENT MAKERS

English Tweezers 5/6
English Pin Vises 5/6
Single Drivers, 5 sizes, 2/6 to 3/6
Eyeglasses .. .. 6/6 & 8/6

Engineers' Special Outside Screw Calipers, 4" Dividers and inside Screw Calipers, each 4/6

NURSES' ARMY, Small 4/9
Large 6/6
7" DRESSMAKERS' Scissors 12/6
10" TAILORS' SHEARS 27/6

SURGEONS' SCALPELS
SMALL 4/6
LARGE 5/6

Many other uses—Hobbyists, Chiropody, Photography, etc.

SAE Socket Sets, 12 Sockets, 2 Extensions, Brace, Universal and Bar, in metal box £3/17/6

Brand New Army Spotlights

Suitable for shooting or for use on trucks, cars, etc.

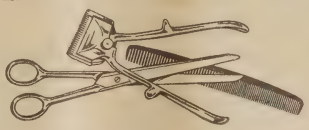
Price .. 17/6

British Pocket Folding Telescope 3X.

Strongly Made 37/6

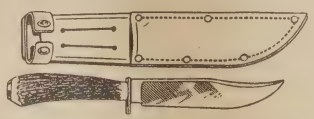
Optic Glass Lenses.

Brand New Chrome Plated 6-12 volt Spotlight. Ideal for spotlight shooting or as a car backing light Price 26/9



British Make Hair Cutting Set.
Clippers 12/6
Scissors 11/6
Comb 2/-

2-Piece Steel Fishing Rod .. 10/6
Bakelite Reel 5/9



British Make, Horn Handled Sheffield Steel Hunting Knife .. 22/6

BRITISH CRESCENT TYPE SHIFTERS

6" 12/6, 8" 13/9, 10" 16/9, 12" £1/3/6.

PHOTOGRAPHIC BROMIDE PAPER—KODAK

Fraction of New Price

5½ x 5½	5/- per pkt	144
8½ x 6½	12/6 "	" "
9½ x 7½	17/6 "	" "
15 x 12	25/- "	" "
10 x 10	22/6 "	" "

FLEXIBLE SILVER CINE SCREENS

6' x 42" 12/6

BRAND NEW WESTON DOUBLE READING MILLIAMPMETERS

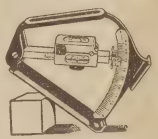
0-40 0-120 25/- each

BRAND NEW BRITISH METRO-VICKERS

0-1 Milliampmeters
3½" diameter 32/6

Brand New American Weston Voltmeters 0-50V £2/2/-

0-50 volts 0-100 amps combined £3/10/-



ARMY ANGLE MEASURE

Ideal for BUILDERS, SURVEYORS

Measures Angles in minutes £3/15/-

Brand New American Micro Switches 6/-
RAAF Sleeping Bag. Brand New. PRICE £3/5/-
Airplane Clocks, English Smiths £3/5/-
American 8-day £5/5/-
Limited Stocks.
Brand New English Alarm Clocks 25/-
Dental Inspection Mirrors .. 5/6
Hikers' First Aid Kits. Brand New. Don't be without one .. 3/6
18" x 12" perspex .. .. 17/6 sheet
26" x 13" .. .. 22/6 sheet
18" x 10" .. .. 17/6 sheet
13" x 11" .. .. 10/- sheet
Hobbyists' Drills, Sizes 54-60
English Diag.-Cutting Pliers .. 6/6
Dental Porcelain Cement 8/6
RAAF Leather Money Belts .. 5/6
Solid Leather Purses 2/6
Large Special Hikers' Haversack Extra Good 19/6
American Feeler Gauges 8/6
100yd Reel Telephone Wire .. 17/6
0-500 Micro Ampmeter 25/-
Inflatable Rubber Boats .. £5/5/-

SURPLUS STORES

Mail Orders Carefully Packed

PLEASE ADD FREIGHT OR POSTAGE

STORES

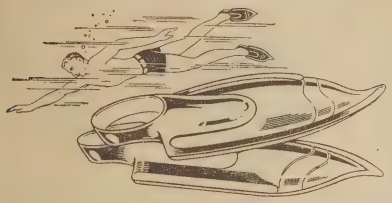
512 ELIZABETH ST., MELBOURNE, C.I.
Victoria Street PHONE: FJ5904

Brand New English "Smiths" make Stop Watches.
£4/10/-

Altimeter or Height Meters. Lots of interest and very instructional, 30/-.

SPECIAL
0-350 Pyrometer £2/10/-
Complete with Thermocouple.

WARTIME FROGMEN'S SWIMMING FINS

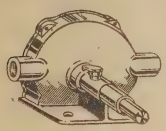


AS USED BY COMMANDO TROOPS

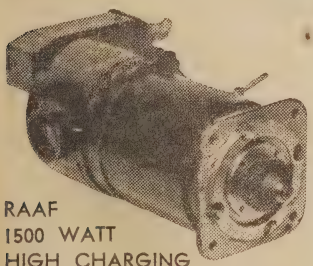
£3/7/6

INCREASE SWIMMING SPEED 40%

Ideal Spotlight for Shooting
2 cell 9/11, 3 cell 12/6
Complete with Batteries

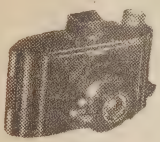


400 GALLON PER HR. WATER PUMP
Fresh or Salt Water—Wholly non-ferrous metal
£3/19/6



RAAF 1500 WATT HIGH CHARGING RATE 24v. GENERATORS £13/15/-

12 volt 42 Amp Charging Generators. Suitable Home Lighting Plant, etc. Price £10/10/-

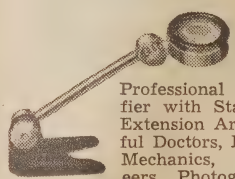


ENGLISH SURPLUS CAMERAS

FILMS 1⅝" x 2½". FOCUS 5¾" TO INFINITY. TELESCOPIC VIEW-FINDER. LGHTWEIGHT, ONLY 7 ozs. SNAP-SHOT OR TIME.
A REAL BARGAIN £3/3/-

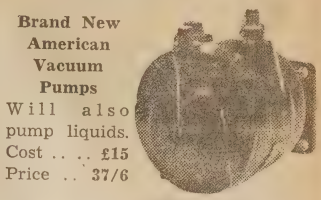
DRILLING OR ENGRAVING HANDPIECE
Brand New . . . . . 20/- each.

Burrs 2/6 packet of 5



Professional Magnifier with Stand and Extension Arm. Useful Doctors, Painters, Mechanics, Engineers, Photographers. Price 32/6

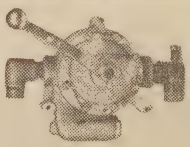
Tecnico Brand New Sapphire Needle Crystal Pick Up, ex Amenities. Worth £6/5/-
For £3/15/-.



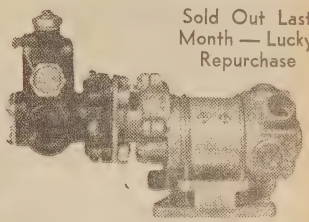
Brand New American Vacuum Pumps
Will also pump liquids.
Cost £15
Price . . 37/6

R.A.A.F. AIRPLANE COMPRESSOR
Two Stage
Limited Number
Highest Quality
£5/5/-.

Genuine American Delco 24V. AC or DC Motor
Worth £6.
1-8 H.P.
£2/15/-



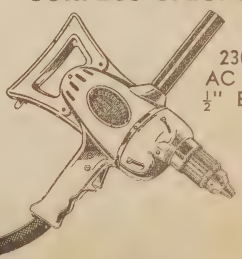
AIRPLANE DOUBLE ACTION PUMP
Pumps High Volume Quickly. Invaluable in country, worth £7/10/-.
ONLY 55/-



Sold Out Last Month — Lucky Repurchase

American 24 Volt MOTOR, and 400 GPH PUMP Combined. Ideal for use of Home Lighting Plants.
£5/5/-.

SURPLUS SPECIAL



British 230 Volt AC or DC ½" Electric Drill

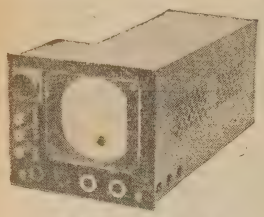
Never again at this price. Brand new. Limited stock £16/10/-

Telephone FJ5904

and Efficiently Despatched
INCLUDE STATE IN ADDRESS

230 Volt Tapped Stepdown Trans., 6v., 12v., 18v., 24v.
37/6

RADIO SPECIALS



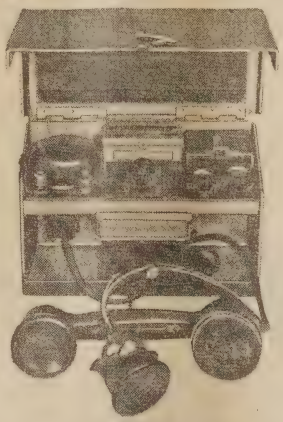
CATHODE RAY INDICATOR UNIT TYPE A1

This is an ideal unit to be converted to an oscilloscope or stripped for the excellent parts, valves, etc.
Parts are 1—5BP1 Valve complete with socket and nu-metal shield, 6—6AC7 (1852) Valves, 3—6H6 valves.
12 — Potentiometers.
10 — Block Condensers.
40 — 1 Watt 1RC Resistors.
1 — 3 Position 2 Bank Switch.
1 — Toggle Switch.
All enclosed in neat metal case as illustrated. Easily worth £25.

Our price **£8/10/-**

A.T. 300 TRANSMITTERS

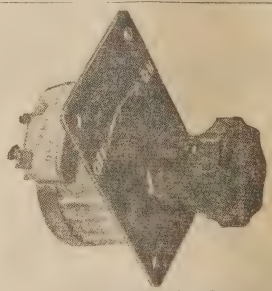
This Radar Transmitter uses parts listed below and is valuable for stripping as well as use in its present form.
Parts Include.
2 — AV11 Valves.
2 — Cyclatron Valves.
2 — 4-Pin Ceramic Sockets.
1 — 24 Volt Motor.
2 — .01 5000 Volt Working Condenser.
1 — .02 10,000 Volt Working Condenser.
1 — .001 5000 Volt Working Mica Condenser.
3 — Transformers (Heavy Duty).
1 — 0-100 Volt AC Meter which is an 0-1 ma movement with 1 ma Dry Metal Rectifier fitted.
1 — 0-50 ma DC Meter.
(and many other parts such as stand off insulators, coils, etc, easily worth £20, our price only **£4/19/6**



TELEPHONE

We have just obtained stocks of the famous Don 5 Telephones, each phone equipped with new batteries, hand set and buzzer, in good working order, suitable for office, farm or factory.

A genuine bargain at **£2/15/-** ea.



RHEOSTATS

Bargains in Heavy Duty Rheostats.
1RC 250 OHM 25 Watt, wound on Mica and Porcelain insulated as illustrated 3/11
100 OHM Heavy Duty Rheostat, as used in English Aircraft 2/3

PLEASE NOTE!

ALL PARCELS WILL BE SENT REGISTERED POST UNLESS OTHERWISE STATED.
POSTAGE MUST BE INCLUDED WITH ORDER.

FEATHERING MOTORS

IDEAL FOR THE AMATEUR

These motors are reversing, have brake to hold them in set position, can be operated off 24 volt supply either AC or DC. These features make it ideal for a rotary beam antenna, etc. Our price, only **£5/-/-**

WIRE

This rubber-covered wire is just the thing for extension speakers, indoor aerials, bell wires &c. Available only in 100yd coils in red, green and black.
Price per coil **10/-**
Special Price for large quantities.

0-1 MA METER CALIBRATED

This is an English meter made by Metropolitan-Vickers Scale 2½" Diameter. An excellent job for use in Multi meters, etc.
Internal resistance 100 OHMS, Sensitivity 1000 OHMS per Volt, all Brand New and Boxed,
Only **£1/12/6**

MOTOR SPARES LTD.

547 ELIZABETH ST. MELBOURNE.

A COURSE IN TELEVISION

(Continued from Page 59)

stage. The conversion gain is low, which is an obvious disadvantage.

As previously mentioned, many receivers have appeared on overseas markets which omit the RF stage for reasons of simplicity. In this case the difference between the various mixer circuits are emphasised and the designer has the task of selecting the one which gives the best overall balance between noise factor and gain.

The foregoing circuits have not emphasised requirements in regard to IF separation. However, where the sight and sound signals occupy adjacent channels it is usual for them to be tuned and amplified by the same RF section, then divided at or after the frequency changer.

The inter-carrier system, referred to earlier, is an exception to this practice and will be considered later in a special article.

With this exception the system already inferred by figures 1-4 seems the most attractive. The signal frequency circuits are made sufficiently wide to accept both the sight and sound carriers and both are applied to the signal grid of the mixer valve.

TWO FREQUENCIES

When combined with the signal from the local oscillator two distinct intermediate frequencies are produced, their separation being equal to the original separation between the two carriers.

Both signals are present in the mixer plate circuit and made available to separate IF channels, either directly or through a low impedance coupling circuit.

There are exceptions to this practice, however, which should be mentioned for the sake of completeness.

Some receivers, for example, have employed two separate converter valves, each receiving a proportion of the signal input voltage. Their respective oscillators are linked in a common push-pull circuit, the output plates feeding the separate IF channels. While this in itself is a neat scheme its application is limited to the lower frequencies where converter valves are practicable.

A variation is to have the input signal fed to the grids of two separate mixer valves, which can be either triode or pentodes, according to the designer's choice. A single separate oscillator is employed injecting a voltage into both grid circuits. The IF channels are then fed from the plates of the individual mixers.

Yet another possible arrangement is illustrated in figure 5. Here a pentode mixer is employed in association with a separate oscillator.

The video IF channel is connected in the plate circuit and the audio channel in the screen circuit, the two being effectively isolated.

HOME DELIVERY PHOTOGRAPHIC EQUIPMENT

Order your photographic needs from Federal Photographics. All equipment comes via mail, promptly and safely.

ENLARGING MASK

- All steel.
- Brunofixed for anti-corrosion.
- Matt Black to ensure clean masking.
- Easy to use—simply adjust to size required and lay on your bromide paper when exposing.

The use of an enlarging mask is a real necessity for the darkroom fan who takes pride in the appearance of his enlargements.
No more trouble or annoyance with curved paper—no fussing about with home-made gadgets to keep the paper flat—and every print will have beautifully sharp straight edges.

PRICE 11/-
Post Free.

DEPENDABLE FOOTSWITCH

- 250 Volt 5 amp switch.
- Heavy cast base prevents sliding on floor.
- Supplied with 4ft. flex.
- Leaves hand free.

This footswitch answers the problem of providing vibration free switching for floodlights, enlarging, copying, printing, etc.

PRICE 19/6
Post Free.

Also suitable for other electrical apparatus such as beaters and machines.

Assemble your own AMATEUR ENLARGER

SAVE UP TO 50% in one evening.
With complete BHC enlarger kits, plus simple step-by-step instructions and few tools, assemble your own enlarger in one evening.
CONSTRUCTION.—Fine grade aluminium alloy casting and steel spinings for lightness and durability. Precision machined to tolerances found in high priced enlargers.
FOCUSING ADJUSTMENT.—"120" has smooth operating friction drive, both for accurate focusing.
NEGATIVE CARRIERS are of clear glass.
DIFFUSION SYSTEM.—Flashed opal for even distribution of light.
SINGLE MENISCUS LENS SUPPLIED WITH ALL UNITS AT NO EXTRA COST.

easy PRINT TRIMMING

B.H.C. all steel print trimmer, 10" 17/6
Post Free.

BHC 120

For 3¼ x 2¼ negatives.
Kit, complete with every part £9/8/-
Assembled £10/11/-
Price includes postage.

BE SURE TO WRITE FOR PRICE LIST AND PAMPHLETS ENCLOSING STAMP FOR REPLY.

FEDERAL PHOTOGRAPHICS .... DIVISION OF BEAUMARIS HARDWARE CO.
22 DALGETY ROAD, BEAUMARIS, VICTORIA. • Phone: Chelt. 1511.

SHORT WAVE NOTES BY RAY SIMPSON

RECEPTION POOR ON ALL BANDS

New Philippine Unidentified

For nearly a month now, a new Philippine Island station has been heard on 4.98 mc, but its identity has defied all listeners at time of writing these notes. The prime reason for this is the particularly high noise level on this band which of course is quite usual at this time of the year. It looks as if we will have to wait for a favorable night when it should be possible to find out who it is.

ON the first night we heard the station we were quite sure the call was DYBR, but on listening to the station a few weeks later the call then sounded like DYBC. In either case, this would have been the broadcast band call, as the short wave call sign would be three letters followed by a figure. We can say definitely that the first three letters of the call are DYB, but the last one is so far unknown. The only other clue to its identity is the fact that we heard it announce as Manila Broadcasting Corporation, but even this does not prove that the station is actually in Manila, as it could easily be in Cebu or some other city.

When first heard, it always closed at midnight, but recently we have heard it till as late as 1.0 am, so would not be surprised if it remains on the air until 2.0 am. Programme consists of request recordings, when various people are called and records dedicated to them.

We have had reports on this station from various other listeners, but no one seems to be able to give any further information beyond the fact that it is in the Philippine Islands. We have sent a report to the Radio Control Organisation in Manila, and asked them to kindly forward to the station concerned, so we hope by next month we may be able to give readers full information on this interesting new station.

RECEPTION GENERALLY POOR

Despite the unusually large number of new stations reported this month, conditions have not been particularly good on most bands, as there has been a rather high noise level, and signals themselves not very strong. There have been exceptions, of course, mostly the high powered American and European, but others, such as the Africans and South Americans have been very much weaker than a few weeks ago.

The 13-metre band has been good on some nights, and, in fact, when it comes good it makes a proper job of it and provides excellent entertainment. We hope that over the Christmas and New Year holidays, conditions are favorable, so that we may log some of the stations only heard at that time.

WHAT IS YOUR VERIFICATION SCORE?

One of the main sidelines of our interesting hobby is the collecting of station verifications from all the stations heard on the various short wave bands and once the first dozen have arrived, one is always looking for the postman to see what fresh prizes he will bring.

Malta Station Heard

MALTA: The Forces Broadcasting Station in Malta, which for some time has been operating on 4.78 mc., has now been heard in South Australia by Rex Gillett on one of their alternate frequencies, 7.27 mc., but on this particular channel was badly mixed up with Moscow, which also uses this frequency. Rex heard them best from 6.30 am to 7.30 am, but at our location we have been unable to log them on this channel.

However, the day we write these notes, we heard them at very good strength on 7.22 mc. from around 6.30 am, though by just after 7 am they had began to fade rather badly. We suggest that listeners watch their other two outlets, 6.14 mc. and 11.785 mc., as they have already been heard on the former by Art Cushen.

U.S.A.: Once again the American stations provide us with a few more changed call and frequencies. Among those we have noticed since last month are WNRE on 9.55 mc, heard well at 7 am; WNRA on 9.615 mc., giving the UN programmes at the same time; WRUW, on 11.71 mc., also at 7 am, and asking for reports on this new channel; WLWL, on 18.16 mc, with Press Opinion USA at 6.45 am; KNBA, on 9.7 mc., with United Nations programme at 5.15 pm; KNBA, on 6.18 mc., and KNBX, on 9.75 mc., opening with the V. of A. programmes at 7 pm.

In addition to the above, we have noticed the Honolulu station **KRHK** using the new channel of 11.79 mc at excellent strength from 7 pm. There may be a few more, but readers will possibly have already found them.

IT is remarkable how soon one can obtain verifications from many different countries, and in no time the total reaches 50 odd. It is from then onward that the going becomes a little harder, and as you reach the 100 mark, it sometimes takes months between each one before you finally reach the century.

So that all readers will know who are the leading DX-ers in this regard, we propose to publish about every three months a list showing the totals of those readers who send us their reports.

What we want to know is: Total number of countries verified, total number of first Australian or New Zealand verifications, and grand total of verifications. Please confine your totals to the commercial short wave stations, and do not include amateur verifications.

We will list all readers who have more than 50 countries verified, so send in your figures in time for next month's issue. We know of at least one Australian and New Zealand listener who has well over the 100 countries, and perhaps there may be quite a few more.

SHORT Wave Notes for the February issue are due on January 7. For the March issue they are due on February 4. Please send them direct to Mr. Ray Simpson, 80 Wilga Street, Concord West, NSW.

THIS MONTH'S NEW STATIONS

PAKISTAN: A welcome change has been made by the Karachi station APK, which has changed frequency from 11.885 mc. to 11.77 mc. It appears to come on the air at 10 pm, when it gives news in English till 10.10 pm, and then changes to a native type language news session. Strength is very good and overrides YDE, the Batavia station, which is also operating on 11.77 mc, though, of course, there is a heterodyne whistle.

This station is louder on this new channel than on any previous frequency, and no difficulty should be had in obobtaining sufficient material to furnish a report which we feel sure will be verified. Later: Miss Dorothy Sanderson now also reports Karachi on 7.64 mc., with news at 10 pm.

INDONESIA: The long-heralded 100 kw. transmitter of Radio Indonesia appears to have taken the air, as we have now been hearing this station strongly on 6.045 mc. in parallel with YDC, PLB9 and YDB3. The best time to listen is between 9 pm and 10 pm, when they have their programme in English. At 10 pm the call letters are given, but up to the present they have made no mention of 6.045 mc.

Unfortunately, reception is spoilt by the fact that Singapore is now also using 6.045 mc., so, of course, once again we have a very bad whistle. We suggest that you watch their other new frequency, 11.795 mc, as they may commence test transmissions on this channel also.

COSTA RICA: Art Cushen was the first to advise us about a new Costa Rican station he was hearing on 9.645 mc. It was heard in New Zealand from 1 pm to 3 pm, but so far we have had no reports of it being logged in this country. The call letters are **TIFC**, and slogan "Lighthouse of the Carribean." Closing tune is a hymn, with choir and organ. According to "Sweden Calling" DX-ers, this station is only using 350 watts and also use the slogan, "Faro del Caribo." Programmes are of a missionary nature and very similar to those heard from HCJB. This is rather a hard channel to log over here, especially in the early afternoon.

PHILIPPINE ISLANDS: The long-awaited new outlet of the Far East Broadcasting Co. has at last been heard in the 31 metre band. This new one is DZH7 and is operating on 9.74 mc., instead of 9.73 mc, which was the frequency advised by the station when they verified DZH6. Quite possibly they have chosen 9.74 mc. to escape interference from the Chinese station, which uses 9.73 mc.

Strength of signal is not particularly loud, but by careful tuning sufficient can be copied to compile a report. Programmes are mostly of a religious nature, and they announce every fifteen minutes as "Stations DZAF, DZH6 and DZH7, in Manila, the time in the Philippines is now ——." Listeners should watch out for their other outlets, DZH8 and DZH9.

COLOMBIA: For those listeners who have had difficulty in logging some of the South Americans, an excellent opportunity was available on Sunday afternoon, December 11. On that day, **HJFB**, in Manizales Colombia, was evidently broadcasting a special late programme as they remained on the air until 7 pm, EAST, and during the last hour were coming in exceptionally well.

About every fifteen minutes they identified themselves as "Radio Manizales," and at more infrequent intervals gave their call letters, **HJFB**, and also another call which would no doubt be the broadcast band outlet. The entire programme was dance music from some hall, as the dancers' applause could clearly be heard at the end of each item. Frequency was 6.22 mc.

THESE STATIONS VERIFY

FZP8, TAHITI: In last month's Flashes From Everywhere, we mentioned that Ken Boord, in the USA, had received his verification from FZP8 "Radio Oceania," and we are now pleased to advise that letters of verification are now being received in this country. Details are similar to those we gave last month, and the letter is written in French, with a few station details in English at the bottom. According to word received from an American listener, he states that the station advised him that it was no use sending International Reply Coupons to FZP8, as they could not be changed. It would seem, therefore, that letters may be answered without.

YVMO, VENEZUELA: This was a very popular station a few months ago, when it was being heard well around 8.30 pm to 9 pm, and it is therefore pleasing to know that verification letters are now arriving in Australia. Although the station was being heard on 4.98 mc., their letter shows their frequency to be 4.94 mc. for short-wave outlet. YVMO and 1270 kc. for the broadcast band station, YVMP. Verification letter is in Spanish and signed by Senor R. A. Segura. In addition to thanking for the report, they state they appreciate further reports from time to time, and give their address as Apartado Postal 76, or Avenida 20 No. 346, Barquisimeto, Venezuela.

ZRB, SOUTH AFRICA: An interesting letter of verification has just been received from the Lady announcer at ceived from the lady announcer at station on 6.21 mc. and advising that this was the first and only report received from Australia for this frequency. Miss Pethesbridge goes on to say that ZRB is now only using 9.11 mc., as, due to a shortage of spares, the SAAF have had to take over their other two outlets, 7.445 mc. and 6.21 mc., as these are required for communication with Marion Island and the Air Ministry. Due to shortage of staff, they now do not broadcast on Sundays and close on weekdays at 11.15 pm, which, of course, will make it very difficult to log in Eastern Australia.

ST. DENIS, REUNION: This is one of the best verifications we have heard of for a long time, and the lucky recipient is that very keen South Australian DX-er, Rex Gillett. Incidentally, this made the 110th country Rex has verified, which is indeed a very fine effort. In their air mail letter of verification confirming his reception on 7.17 mc., they stated that they are also transmitting on 4.8 mc. Schedule is 11.30 pm to 12.30 am, and on the first channel they can be heard at fair strength, although usually spoilt by amateur stations on the same and nearby frequencies. Programmes are in French and the station can easily be recognised by their playing of the Marseillaise on closing at 12.30 am.

FLASHES FROM EVERYWHERE

MARTINIQUE: Some years before the war we were used to hearing Radio Martinique, operating on 9.7 mc. in the early mornings, but we have had no reports on it for a very long time now. According to a recent issue of Sweden Calling DX-ers, this station, which is located in Fort-de-France, has been heard testing on 8.185 mc. and 12.905 mc. from 2230 to 2300 GMT, which is, of course, 8.30 am to 9 am EAST. The engineers at the station said that another frequency, 10.23 mc., would also be used at a later date. It is thought that this may have been a test transmission from their new 50 kw. transmitter, so listeners should keep a watch on the above channels.

ANGOLA: From the same publication we have information regarding experimental transmissions being made by the Radio Cluba Louanda in Nova Lisboa These test transmissions were being directed to the Belgian Congo and French Equatorial Africa, and were being made on 11.925 mc. Although we have had no reports of it being heard in this country, it was heard in Europe around 6.30 am, when the programme was in French and also Portuguese. The station was asking for reports, which should be addressed to Radio Cluba de Louanda, PO Box 125, Nova Lisboa, Angola. As quite a few of the other Angola stations are heard out here, we have no doubt that it will not be long before someone reports hearing this new one.

VATICAN CITY: We often receive inquiries as to what times HVJ, the Vatican Radio, can be heard, and we would like to advise that it is now coming in quite well on 9.66 mc. from about 1.15 am, which, of course, is not very convenient for many listeners. However, the station can be heard on 5.97 mc. and also on 6.19 m. at 6 am, and prior to that it has also been logged on 7.28 mc.

A new 100 kw. transmitter for HVJ is being constructed by Philips Radio of Holland, the finance being supplied by Catholic people in that country. It is stated that this new transmitter will be completed in 1950 and will be presented to his Holiness Pope Pius XII to commemorate Holy Year.

SS MONOWAI: During this past month we have been very interested in the transmissions from the well-known liner Monowai, which runs between Australia and New Zealand. Communication is made between the stations' transmitter ZMCD on either 4.426 mc. or 8.852 mc. (the latter being the strongest usually) and VIS, Sydney Radio, which uses various channels, depending on the time of day. One of the loudest is 6.505 mc., which is really excellent. Indicating the difference in receiving conditions in quite a small area, VIS was unable to hear ZMCD on 8.825 mc, though at our own location the ship's signals were being logged at maximum level. It was amazing that Sydney Radio, with all their facilities, could not hear ZMCD.

EIRE: It is very seldom that we hear of reception of any of the Eire short-wave stations, and, for that matter, overseas listeners seem to be in the same category. However, according to a recent issue of Radio News and Television, the Chief Engineer of the station has stated that they broadcast news at 10.30 pm and 3.30 am. While no frequency was given, it is presumed that it was on either 9.595 mc. or 17.84 mc. A new 100 kc. transmitter is in course of construction and is expected to be on the air before the end of the year. This transmitter will beam its programmes to North America and will operate on any of the following channels. 6.19 mc, 9.595 mc., 11.74 mc., 15.12 mc or 17.84 mc. Keep a watch on these channels for this elusive station.

NEW STATION LOGGINGS

Call	KC	Metres	Location	Time heard
Batavia	6045	49.63	Batavia, Java	9.00 pm
B.F.E.B.S.	6045	49.63	Singapore, Malaya	9,00 pm
F.B.S.	6140	48.86	Malta	5.00 pm
KNBA	6180	48.54	Dixon, Cal., USA	7.00 pm
HJFB	6220	48.23	Manizales, Columbia	6.00 pm
YBD	7100	42.25	Djokjakarta, Java	12.30 am
St. Denis	7170	41.78	St. Denis, Reunion	11.30 pm
F.B.S.	7220	41.55	Malta	7.00 am
F.B.S.	7270	41.27	Malta	7.00 am
APK	7640	39.27	Karachi, Pakistan	10.00 pm
Vietnam	9050	33.15	Indo China	9.00 pm
WNRE	9550	31.41	New York, NY, USA	7.00 am
WNRA	9615	31.20	New York, NY, USA	7.00 am
TIFC	9645	31.10	San Jose, Costa Rica	3.30 pm
KNBA	9700	30.93	Dixon, Cal., USA	5.30 pm
DZH7	9740	30.80	Manilla, Philippine Is.	9.00 pm
KNBX	9750	30.77	Dixon, Cal., USA	7.00 pm
4VRW	9795	30.63	Port-au-Prince, Haiti	10.00 pm
WRUW	11710	25.62	Boston, Mass., USA	7.00 am
APK	11770	25.49	Karachi, Pakistan	10.00 pm
KRHK	11790	25.45	Honolulu, T.H.	7.00 pm
BED2	11800	25.42	Taihoku, Taiwan	9.00 pm
ETA	15055	19.92	Addis Ababa, Ethiopia	12.30 am
WRUA	15210	19.72	Boston, Mass., USA	1.30 am
HEI8	17795	16.86	Schwarzenbourg, Switzerland	1.00 am
WLWL	18160	16.52	Cincinnati, Ohio, USA	7.30 am

HUNGARY: We have just received a letter from the Relations Department of the Hungarian Radio, which reads as follows: The Hungarian Radio has pleasure in informing you that, as from November 1 this year, it will begin broadcasting on the frequencies of 6.247 mc. and 9.82 mc., with a power of 2kw. For the time being, the service will consist only of news broadcasts of 15 minutes' duration. Listed below please find the schedule in GMT: 1720, News in Russian; 1800, news in French; 1920, News in German for Austria; 2030, news in German; 2130, news in English. This latter broadcast, which corresponds to 7.30 am, EAST, can be heard very faintly on the 9.82 mc. channel, but is very hard to copy.

Singapore Frequency

MALAYA AND INDO-CHINA: Rex Gillett was the first to advise us that Singapore had changed frequency from 6.77 mc to 6.045 mc. Although this change was a good one at the time, it is now spoilt by Batavia, which is also using this frequency. (See paragraph this issue.) Another new station from this part of the world is one in the Vietnam portion of Indo-China, and which is operating on 9.05 mc. nightly.

The programme is mostly in native-type language, but at about 9.20 pm there is usually a talk in English by a lady which deals with the various oppressive actions taken against the Vietnam people and their solidarity in eventually obtaining their freedom. No location has been heard either during English session or other times.

ETHIOPIA: In giving the following station as a new one we may not be strictly correct, but as far as we can recollect it has not previously been heard on its present frequency of 15.055 mc. We refer to ETA, the Abbas Ababa transmitter, which for some time now has been heard at reasonable strength from just after midnight. English recordings are heard from around 12.15 am, and then at 12.30 am a talk in English is given, followed by news in English at 12.45 am.

Quality is rather poor, but otherwise it is quite easy to copy and we think will definitely verify listeners' reports. ETA was formerly on 15.075 mc., and has probably changed frequency to escape interference from GWC on 15.07 mc.

RADIO ACCESSORIES

We specialise in Radio parts and stock all reliable brands. We can supply: Coils, I.Fs., Transformers, Resistors, Tubular Condensers, Valves, Wires, Flex, Meters, Testing Equipment, Radio Manuals, Irons, Toasters, Pressure Cookers, Jiff Toasting Irons, Trimmers, Padders, Gang Condensers, Cabinets, Motor and Pick-ups, Record Changers, Solder Irons, Solder and Electrical Accessories. 4 and 5 Valve Mantel Sets—Portable Sets, Console Radios and Radiograms, etc.

We are distributors for Radameter Testing Equipment including Valve & Circuit Tester—Miniature Multi Meter, Oscillators Etc. Inquiries invited.

DAVIS RADIO CO.,

Wholesale Radio Distributors.

1st Floor—Wembley House, 841 George St., Sydney. Phone M3917

(OPEN SATURDAY MORNINGS)

THE ANNALS OF ELECTRICITY

(Continued from Page 11)

Scientific circles took up Oersted's discovery in a spirit which was akin to a furore of excitement. Honors and congratulations avalanched upon him. Our own Royal Society at once bestowed on Oersted its highest honor—the Copley Medal, while other European societies responded in a more practical manner still with monetary gifts.

The Oersted discovery was, without a doubt, one of the highest practical importance in the science of electricity because it so conclusively established the intimate relationship between electricity and magnetism. Yet Oersted himself did little to develop his discovery in any practical manner. He missed the invention of the electric magnet and he even let others discover the principle of the galvanometer, which latter device was first introduced in the following year (1820) when Professor S. C. Schweigger, of Halle, devised his famous "multiplier," consisting merely of a few turns of insulated wire set around the compass needle, the several turns of wire thus "multiplying" the amplitude of the needle's deflection.

It must be admitted, therefore, that Hans Christian Oersted was guilty—perhaps pardonably—of resting on his oars after his famous discovery had become generally known. The big developments in electro-magnetism came at the hands of Ampere and, more so, of the illustrious Michael Faraday.

SUCCESS BRINGS SUCCESS

Right up to his death at Copenhagen on March 9, 1851, Oersted remained enshrined in his celebrity. He reached the status of a national hero of Denmark. The Danish King bestowed new titles upon him. The Danish Government presented him with a country house and a country estate near Copenhagen.

In a book entitled, "The Soul in Nature," which Oersted published towards the end of his life, he showed that his interests had shifted more and more to politics, sociology, poetry and even metaphysics, and that plain science had become relegated more to the background of his mind and activities.

Yet, even in our times, Oersted's phenomenal fame has persisted. Today we apply to the unit of "reluctance" (which is the magnetic equivalent of electrical resistance) the name Oersted, thus perpetuating the memory of a much famed individual who, if he did nothing else of fundamental importance, at least brought the phenomenon of electro-magnetism into practical being.

EPILOGUE

Was Hans Christian Oersted, of Copenhagen, absolutely the earliest originator of electro-magnetism?

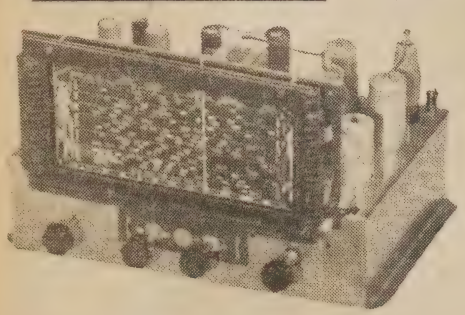
Standard histories, which our article above has followed, unite in answering such a query in the affirmative, but then, of course, official histories frequently have a knack of being completely incorrect on many material points.

It is true that Oersted was an independent discoverer of electro-magnetism. But independence is not synonymous with priority in the matter of discovery and invention. And, in this particular connection, it seems to be a fact that as long ago as 1802, an Italian savant, one G. D. Romagnosi, of Trent, learning of Volta's discovery of the electric "Pile" or battery, announced in a public pamphlet or other similar communication that he had observed the power of an electric current travelling through a wire to deflect a compass needle when the said wire passes near the needle.

Such is a claim which has been made, and which, if verified, would completely dispossess Oersted of the priority of the first discovery of electro-magnetism. Owing, however, to the upheaval in Europe, the investigation into Italian scientific archives and other sources cannot be made. The speculation on this important matter of priority must, therefore, still remain an open one.

SUPER EAST / WEST RADIOS

5 Valve Dual Wave Radio Chassis



Complete with 12" 'Rola' speaker and five valves

Buy direct at factory prices and save up to £10/-/- on your purchase. This chassis is the latest model and is equipped with tone control, large modern edge lit clearly marked dial, phono pick-up terminals, and the latest type valves **£16/17/6**

Country orders must allow for packing and freight, which costs approximately £1/10/-.

Write direct to us:

ELECTRICAL DISTRIBUTORS PTY. LTD.

Second Floor, Crystal Palace Building, 590 GEORGE STREET, SYDNEY.

6 Valve Super Short Wave and Broadcasting Mantel model type chassis with 8" speaker mounted—price £26/7/6 without cabinet. Write for further particulars

THE HAM BANDS WITH BILL MOORE

Field days are perhaps the most popular form o f entertainment in amateur radio circles, and the NSW WIA field day held on November 27th at Woy Woy was no exception.

THE site was convenient for members of the Hunter Valley and Sydney sections, besides covering the coalfields and lakes area. The day attracted amateurs from far afield, including VK2ARY of Bellingen, VK2OY of Goulburn, VK2DO of Yass, VK2LY of Katoomba, VK2AMV and 2WH of Forbes, and VK2NS of Bathurst.

The final tally showed 145 persons present, including 78 amateurs.

After lunch the main events of the day were run, including a launch trip on Brisbane Waters for the YL's, XYL's and kiddies, and a transmitter search for the OM's. The latter was run on the 144 mc. band and a wide array of UHF gear was to hand, including transmitter, transceivers and complete mobile stations. Antennae were quite varied, from "Halo" to extensive arrays, not forgetting a few simple dipoles.

The "Hidden" transmitter was supplied and operated by the UHF section of the WIA, and run by UHF officer Vaughan Wilson, VK2VW. Major Collett, VK2RU, was the local identity that selected the site; he did a good job, as in over an hour of operating only one competitor located the position, and it took them 40 minutes to do so. The party, VK2PW, 2ARF, 2ASM, and Cec Cronan used a three-element beam, super-regenerative receiver and vibrator power supply.

The splendid efforts of the local amateurs in making the day so pleasant was appreciated by all present, and Mr. and Mrs. Lee Hardman, VK2KR, as the genial host and hostess, did a fine job.

THE UHF'S

THE NSW WIA UHF section has decided to run a 50 mc contest between the beginning of December and late January. Any amateur in Australia and New Zealand can enter, and the contest commenced on December 10 and concludes January 29, at 2359 hours EAST.

After the interesting DX break-throughs of early November, conditions quietened during the middle of the month, and it was not until November 28 that another DX contact was recorded.

On that date at 1230 hrs. EAST, Vaughan Wilson, VK2VW, contacted KH6PP and logged KH6NA, K6BF and a W9 shortly afterwards.

On the following day weak KH6's or W's were heard in Sydney around 0900-1000 hrs. EAST, while at 1135 hrs. KL7AD was heard at good strength, but no contact was made. During the afternoon from 1400-1500 hrs. JA2AZ was S9 on automatic transmissions.

All the wiles of amateur radio were used to try and get him to listen, but to no avail. Many stations on the 28 mc. band were using directional calls to Japan, but with no success.

On November 30, New Zealand stations arrived on 50 mc. in force. Openings so far this year have not been so complete as experienced during last summer

A large number of stations who had no difficulty in communicating with New Zealand last year have been unable to break through. Later in the day, from 1200 to 1300 hrs. EAST, stations north of Sydney contacted Western Australians. Stations in Sydney could not even hear the VK6's, VK2RU, 2AMU, 2ADT and 2VU were the only ones to make contact.

Sunday, December 4, saw the band wide open from all parts of NSW to VK5 and 6.

BERU CONTEST

QUITE a number of changes have been made in this year's BERU contest, and they should all be well received by most competitors.

The first is the advancing of the date forward in the year, for two reasons, firstly to allow the contest to be run during better conditions, and secondly to avoid clashing with contests. The operating period has been shortened to 24 hours each weekend, and this feature alone should attract more competitors

For the first time a Telephony section has been incorporated, running over one weekend, the Receiving section being run in conjunction with the Telephony section.

A trophy will be awarded to the RSGB member securing the highest number of points in each section. Certificates will be awarded to the three leading stations in each section and to the leading station in each prefix zone.

Rules summary:—There are four sections: (a) Senior Telegraphy (150 watts); (b) Junior Telegraphy (25 watts); (c) Senior Telephony (150 watts); (d) Junior Telephony (25 watts).

Contest Periods: Sections (a) and (b), from 1700 hrs. GMT, January 14, to 1700 hrs. GMT, January 15, and again from 1700 hrs. GMT, January 28, to 1700 hours. GMT, January 29. The Telephony sections (c) and (d) are run between 1700 hrs. GMT, January 21, to 1700 hrs. GMT, January 22.

The contest is open to all members of the RSGB or Empire Societies (the WIA in Australia or NZART in New Zealand).

Contacts with ships or unlicensed stations in countries where licences are obtainable will not be permitted.

Only one entrant will be permitted to operate his apparatus for the duration of the contest.

All entries must be posted within eight days of the completion of the contest, and no entries will be received later than May 8, 1950.

THE BANDS

Operation is restricted to the following bands: 3.5, 7, 14 and 28 mc's. The Telegraphy contest is open for CW contacts only, and stations receiving consistent reports of less than T8 will be disqualified. The Telephony section is open for amplitude modulated transmissions only.

Only one contact with a specific station may be made on each band during the contest.

Fifteen points will be scored for the first contact on any specific band with a station located in any other zone outside the competitor's, 14 points for the second, and so on, the fifteenth contact counting one point. All contacts in excess of fifteen counting one point.

Serial numbers must be exchanged and acknowledged before points can be claimed for a contact. The serial number five or six figures is made up of RS (Telephony) or RST (Telegraphy), plus three figures, which may begin with any number between 000 and 400 for the first contact, and which will increase by one for each successive contact: eg, 281 for the first, 282 for the second, &c

The following are the prefix zones (27 in all): AP, VU2, 4, 5, VS7. DL2, G, GC, GD, G1, GM, GW. MBG, MD1 2, 7 (ZC4), MF2, ZB1, 2. MD4 (VQ6), MI3, ST. VE1, 2. VE3, 4. VE5, 6. VE7, 8. VK2, 3, 7. VK4 VK5, 6. VK9, VR4. VO. VP1, 5, 7, 9 VP2, 3, 4, 6. VP8, VK1. VQ1, 3, 4, 5, ZD6. VQ2 ZE. VQ8, 9, ZC2. VR1, 2, 3, 5, 6, VK, ZM. VS1, 2, 4, 5. VS6. VS9, VU7, MP4. ZD1, 2, 3, 4, 7, 8, 9. ZL1, 2, 3, 4. ZS1, 2, 3. ZS4, 5, 6, 7, 8, 9.

Logs should show in the heading: Section in which entering, name, callsign, address, transmitter, input to last valve, receiver and aerial systems used.

The log itself should show the following in the order listed: Date, GMT, band used, mc's, callsign serial numbers sent and received, points claimed. Competitors should certify at the end of the log that their station was operated strictly in accordance with the rules and spirit of the contest, and agree to that the decision of the RSGB Council is final in all cases of dispute. If not a member of the RSGB, you must also certify that you are a fully-paid-up member of the WIA or NZART.

An analysis sheet must also be supplied, showing number of contacts and points claimed for contacts with each zone shown separately for each band.

WIA NEWS

ONE of the most interesting and instructive evenings recorded at NSW WIA meetings was held during November, when a recorded talk on "Disc Recording Standards," made in England by Mr. Mittel and his colleagues of EMI, was presented.

The recorded discussion was illustrated by slides and was introduced by Mr. John Briton and Mr. Reg. Southey, of the Gramophone Co., Ltd.

Various other recordings were played to demonstrate points in talk, and those

THE AUSTRALIAN HOBBY HANDBOOK

★

Fully illustrated articles on Photography, Model Aircraft, Radio, Model Boats and dozens of other things to make and to do.

★

Special Sport Section Cricket, Football, Tennis, Swimming, Boxing, Cycling, Hiking, covered by Australia's best sport writers

Now on Sale

PRICE TWO SHILLINGS

Available All Newsvendors.

in attendance voted the evening very successful.

The 20th Federal Convention of the WIA is scheduled to take place during Easter, 1950, and State divisions of the WIA are working on the various agenda items they will attach to the paper.

The growth of the WIA post war has been considerable, and it is interesting to note that, of all the National Amateur Radio Societies in existence, the WIA has the third largest number of transmitting members; the ARRL and RSGB being first and second, in that order.

The New Zealanders have fallen in line to a large degree with the WIA's "gentlemen's agreement" for the subdivision of our bands into phone and CW, even to the extent of applying to their P. and T. branch for an exclusive CW allocation from 3500 to 3550 kc's. They request, too, that we observe the scheme especially on the 7 and 14 mc. bands. For those that might have forgotten the scheme, and especially to those few 7 mc. telephony men who don't follow it, we list the subdivisions as observed by the majority. CW Sections: 3500 to 3550 kc's, 7000 to 7030 kc's, 14,000 to 14,100 kc's, 28,000 to 28,100 kc's. The remainder of the bands can be used for either CW or telephony, but in practice nearly all CW stations migrate to the low end.

Another new Radio Club came into being in Victoria in late November, when the Moorabbin and District Radio Club was formed. Jim Keenes, VK3KE, is the president, and anyone interested in joining should contact the secretary, Ed. Scott, care Moorabbin Public Library Hall, Moorabbin, Vic.

DX AND PERSONAL

DX for the past month has been very poor, but on odd occasions some better-class DX was recorded. It was a disappointment to many who spent hours calling OY2GA to learn he was located on a ship.

He has been active on 14,110, T7, 1800-2100 hrs. EAST. He was quite honest and his statement to a DL ran rather like this: Sorry OM, no licence, no QSL, on a ship and only work my good friend, OZ5B. For those interested in the Faroes, OY3G, 14,120, T9, 0530 hrs. has appeared on odd occasions.

MP4BAD has left for home and can be found at 6 Arder Lane, Hollings, Oldham, Lancs.

South America's most illusive country, French Guiana, has been represented by FY8AA, 14,004, T9, 2100-2200 hrs. His signals are very weak and hard to copy, as he runs 30 WPM on a bug.

Freddie VP6CD1 has increased power considerably, so he can compete with the W's. A victim of plenty of VFO attacks, he believes that the increase will help. FF8GP was singled out during the month for VFO attention. FM1HR (reputedly in Algeria) kept everyone busy by calling CQ and waiting until the row subsided start all over again. VQ1CUR attracted plenty of attention also during the CQ DX contest. He went across to Zanzibar to holiday and assist in the contest.

More locally VR1C supplied some DX interest and could be contacted if he stopped in the one place for long enough. 14,120 plus or minus 1930 hrs.

ARTICLES of polished tool steel can be heat-hardened without damaging or scaling the finish by coating them with a mixture consisting of equal parts of table salt and fine corn meal. When exposed to extreme heat, the coating melts and forms a flux which prevents oxidation and subsequent qitting of the surface of the metal. First, dip the article in water and then in the mixture. Heat until the coating becomes glazed and dip again into the mixture. Continue the heating process and, if any portion of the coating appears dry, spread the mixture over that point. The coating is removed by soaking in oil or water.

IF a teapot is used infrequently, try dropping a lump of sugar into it after washing and drying. Then, even though the teapot is stored on a shelf for weeks at a time, a musty odor will not be apparent.

AS A REFRIGERATION SERVICE EXPERT

An ever increasing number of homes, both in town and country, are installed with refrigerators. Large flat dwellings have built-in refrigeration — in fact domestic refrigeration has become an essential part of modern life. Industrial refrigeration, too, is extensive and to keep the many thousands of units operating efficiently it is essential that regular periodic servicing is carried out.

For the trained man, there is a good spare-time income to be had from servicing refrigerators. The Refrigeration Service Course is complete and thorough in every detail. You require only an average education to follow the easy stage-by-stage lessons. All classes of refrigerators are covered, the electric, gas, and kerosene absorption types, also cold storage and commercial ice-making plants.

For full information on the Refrigeration Service Course cut out and post the coupon below.

ADD TO YOUR INCOME

REFRIGERATION SERVICE COURSE
DIESEL ENGINEERING COLLEGE
255a George St., Sydney. BU2902.

Please send me, without obligation, particulars and free syllabus of the Modern Refrigeration Course.

NAME.....

ADDRESS..... AGE.....

R. & H., January, '50.

BY SERVICING REFRIGERATORS

YOUR OPPORTUNITY—

to join the world-wide ranks of amateur transmitters! The Wireless Institute of Australia holds regular classes in Sydney to assist Sydney and suburban enthusiasts to obtain their Amateur Operator Certificates of Proficiency.

Write for particulars to the Class Manager, W.I.A., Box 1734, G.P.O., Sydney.

A.O.C.P. CLASS

The Victoria... Division A.O.C.P. Class will commence on Thursday, 12th January, 1950. Lectures are held on Monday and Thursday evenings from 8 to 10 p.m. Persons desirous of being enrolled should communicate with the Secretary, W.I.A., Victorian Division, 191 Queen Street, Melbourne (Phone FJ6997, from 9 a.m. to 5 p.m.), or the Class Manager on either of the above evenings.

1950 RADIOGRAM

(Continued from Page 55)

the cans. If you use the type in which the slugs protrude through the base between the pins you will have to be very careful to leave sufficient room to get a screwdriver in to them.

The short-wave aerial coil is mounted vertically directly behind the volume control with its slug accessible from the top of the chassis. The oscillator coil is mounted on a spacer horizontally from the edge of the chassis. This enables the wiring to be kept short and direct. It is necessary to drill a small hole in the side of the chassis to enable adjustment to be made to the core. While on the subject of coils, make sure that you keep the wiring clear of the bottom adjusting slugs of the I.F. transformers.

TREBLE COMPENSATION

You will notice that there is a small mica condenser wired across the .2 meg resistor in the variable bass boost divider network. This provides fixed treble boost to overcome losses due to the wiring capacities and more particularly to the Miller effect losses of the triode amplifier valves. Without this precaution the output may drop several db at 15,000 cycles. As can be seen from the curves with the compensation applied, the response falls only 1db or so at 15,000 cycles.

It was found necessary to shield the leads to the volume, bass and treble controls, to avoid hum pick-up. These leads are all insulated from the chassis with plastic tubing, as mentioned earlier in the article.

The amplifier section of the set is quite sensitive and most of the available lightweight pickups will have no trouble in driving it, some even without a coupling transformer. For a measured output of six watts across the 2 ohm secondary of the output transformer, the input to the pick-up terminals was only 0.1 volts.

FUN for boys in throwing rocks to break the familiar glass insulators on telegraph poles is on its way out in America. Unbreakable rubber insulators are to replace the breakable glass types now used.

They have already been installed for field testing.

The new rubber insulators are inexpensive, much smaller and weigh only one-tenth as much as the glass ones. Many tests had to be made to find a rubber hard enough for use, but soft enough not to break. The small black rubber insulator developed lets drops of water roll off rather than spread out and cause leakage of electric current.

THE tonnage in a conical pile of coal can be estimated quickly. First, measure the diameter of the pile at its base. Then, multiply the cube of the diameter (in feet) by .00248 for bituminous coal or .00172 for anthracite coal.

OLD TIME DANCE RECORDS

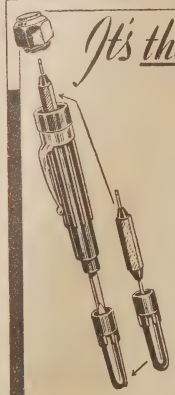
Harry Davidson AND HIS ORCHESTRA (OLD TIME DANCE SERIES)

No. 43—Canadian Barn Dance (Teasing and Walking Home with Angeline)
No. 44—London Tango (Blue Twilight) DX.1364
No. 45—Doris Waltz (Garnett)
No. 46—One Step (Poor Old Charlie) (Morressy) DX.1368
No. 47—Marine Four Step (On the Quarter Deck) (Ricketts)
No. 48—The Imperial Waltz (Original) (Hucke) DX.1383
No. 49—Dinky One Step (Gaily Through the World) (Macbeth)
No. 50—Jollity Barn Dance (Cockney Capers) (Crantock) DX.1394
No. 51—The Honeymoon Parade (Honeymoon March)
No. 52—The Glen Mona Waltz (Love, Here is My Heart) DX.1405
No. 53—Mississippi Dip (Intro.: On the Mississippi; Swanee; Waiting for the Robert E. Lee)
No. 54—Delilah—Waltz DX.1439
No. 55—Evergreen Quadrilles (3 Parts)
No. 56—The Chrysanthemum Waltz (Wild Roses) DX.1459/60

Come in and hear them.

COLUMBIA
The finest name on record

GH.32.12



It's there when you want it!

. . . and you'll find an everyday use for this handy STEAD Pocket Screwdriver! Clips in your vest pocket like a fountain pen; with three sizes of interchangeable blade. A strong, practical driver for every man and every job.

STEAD
POCKET SCREWDRIVERS
SEE THEM AT YOUR HARDWARE STORE
Wholesale enquiries to: H. S. G. WOLFE
255a George St., Sydney.
Made only by J. STEAD & CO. LTD., SHEFFIELD 2, ENG.
4915

COYNES RADIO AND ELECTRICAL BOOKS
The most Popular Books for the Electrical Engineer Published by the Book Department of
COYNE'S ELECTRICAL SCHOOL, CHICAGO, U.S.A.
and Compiled by Coyne's Experts. Write for Illustrated Pamphlet.
Exclusive Representatives for Australasia and New Zealand:
ASSOCIATED TRADE JOURNALS COMPANY,
Frazer House, 42 Bridge Street, SYDNEY, N.S.W.

OFF THE RECORD — NEWS & REVIEWS

The interest in articles appearing in Radio and Hobbies recently concerning the more technical aspects of record listening has been quite remarkable, judging by the number of letters we have received. Apparently we have touched quite a few points which have worried our readers, and obviously thrown considerable light on many of them.

By JOHN MOYLE

MY remarks this month deal with something which nearly every amplifier enthusiast must have asked himself. Let me formulate a typical question.

"The claims made for many amplifier circuits indicate that some are good, some better, and some in the super class as far as reproduction goes. As I haven't a large sum of money to spend, will I lose much by building a modest amplifier, or must I have a big job such as the 'Williamson' to get the good results?"

A question like that can't really be answered in a couple of paragraphs.

GENERAL APPROACH

Approaching the problem in general terms, it is, I think, correct to say that any well-designed amplifier today will add much less distortion to the overall reproducing chain than any other item. It is reasonable to assume therefore, that straight listening tests will indicate comparatively small differences between them, providing they are all operated within their output capabilities, and are correctly built.

The differences that do exist will become more noticeable as the weaker links in the chain are improved.

With the best pick-ups and speakers available, there is some advantage to be gained by taking a little more trouble and spending a little more money. But even so, we arrive at a point where differences between the very good and the absolute best are more noticeable when checked in the laboratory than when heard by the ear.

Let me attempt to interpret what this means in terms of actual equipments.

Many people have no need of an amplifier which produces more than a watt or two of output—roughly equivalent to the average console radio set and do not wish to spend a large sum of money.

Invariably they will buy one of the medium fidelity pick - ups—probably lightweights — and a locally made 12 inch speaker to go with it.

Within those limits, there would be virtually nothing to be gained by using an amplifier more elaborate than a two-stage job with a pentode feeding a valve such as the 6V6, and including adequate feedback.

SIMPLE BUT GOOD

Such an amplifier will give good frequency response well beyond the range satisfactorily handled by the pick-up and the speaker. The amount of distortion in the amplifier will be quite low, again probably well below the total amount of distortion produced more particularly by the speaker, for even the best of these is far from being a distortionless device.

For reasons mentioned more than once, it would be probably a good thing for such builders to buy a good output transformer to feed the speaker, as his requirements will be somewhat more severe than those for which the original speaker transformer was built. This applies more especially to a single ended amplifier than to a push-pull job, for there is no possibility of balancing out the heavy current of the output valve which is a good feature of any push-pull circuit.

EXAMPLE

Only recently we provided such an amplifier for a friend using a lightweight pick-up having a cut-off frequency of about 7.5kc. Even to our somewhat critical ears, the result was very pleasant to hear, and the usable volume level more than enough for the average room.

Our friend was quite musically inclined, and his reaction to the whole job was of complete approval. In other words, it provided excellent value for the money invested. The circuit incidentally, was almost identical with that of the lightweight amplifier recently described.

Would the addition of a more expensive, imported speaker be worthwhile with such an amplifier? Yes, I think it would. Such a speaker is more sensitive than the cheaper types, and therefore gives more output for the same input—it sounds louder. Its smoother reproduction and better bass response are still valuable improvements, particularly if the good quality output transformer has been used.

CRITICAL EAR

To the extremely critical ear, a better type push-pull amplifier would probably sound a little better particularly if a really good pick-up were to be used, but the smaller set-up will still sound mighty fine as long as you don't try to entertain the neighbors with it, and run the high peaks of output too near the maximum of about 4 watts or a little more.

So much for the modest outfits. What happens when we graduate into the higher powered class with push-pull 6V6's, or even 807's?

It is around this class of amplifier that most of the discussion originates, for it is possible, operating on this basis, to build various designs capable of supplying extremely high output with very low distortion.

To keep the discussion here on a practical plane, let us take two examples of such amplifiers — a straight resistance coupled, phase-changer job using push pull and adequate feedback, against a more special type such as the Williamson, which features a direct-coupled phase-changer valve, triode-connected beam output valves, a very expensive output transformer, and heavy feedback.

COMPARISON

In my view, although the Williamson circuit is capable of showing figures many times better than the more standard circuit, we have known in various forms for many years, by far the greater part of this improvement will be seen by test instruments rather than by listening.

The reason is that if we have any amplifier which is so good that its contributed distortion is much less than that from other sources, the improvement we can make is largely masked by this latter type of distortion and the difference to the total

GRAMOPHONE NEEDLES
For the
Connoisseur
pick-up
20 for 6/-
Hard - chromium plated needles with green shanks. Radius of needle point guaranteed accurate to within the tolerance of .002"/.003". Each needle will play 20 sides, and up to 50 without damage to record.
Connoisseur Sapphire Needles .. 13/6 ea.
J.H. MAGRATH & CO.
208 LT LONSDALE ST.,
MELBOURNE C.1. CENT. 3688.

distortion will be very small. We might, for instance, build a straight amplifier with a total distortion of 1.5 per cent. To use another amplifier which has an extremely low value such as .1 per cent doesn't make much difference if the total distortion of the remaining equipment is 10 per cent. And that isn't at all an outside figure, particularly in the higher frequency ranges where distortion is most distressing. The records themselves might easily contribute as much as this, at least in a goodly proportion of pressings.

It is quite true that to talk of distortion as limited to harmonic distortion is to ignore other important considerations such as transient response, which affects brilliance and clarity, but generally speaking, these matters are largely inter-dependent. If our amplifier is clean and flat from about 35 cycles to 25,000 cycles, we can be fairly safe in assuming that these other matters as far as the amplifier is concerned, will look after themselves.

REBUILDING

I would at this point, therefore, answer another oft-repeated question, and say that I don't advise you to scrap a perfectly good straight amplifier in favor of a Williamson, because, apart from the technical changes and expense involved, the chances are that you won't be able to tell the difference. It's nice to know that your amplifier is about the best obtainable, but it is for you to decide whether that probability is worth spending time and money to achieve if the finished job sounds much the same after you have made the change.

Some fortunate readers, to whom expense isn't so important, and who are happy to spend a couple of hundred pounds on their amplifiers and speakers, might possibly be exempt from this statement. But even for them, I would say that I have sat in on many interesting tests, in which various amplifiers have been lined up with specially made switches to change over the entire speaker systems at will, in an endeavor to "pick the difference" between good and superlative amplifiers. I am prepared to believe that the ensuing arguments as to which sounded the best are still going on!

Another way of stating the problem is to say that after one reaches a certain standard in amplifiers, further improvements are possible in the finer points which make for an extra clarity, precision, attack, and over-all response. But the price of obtaining these takes a considerable jump, as may be observed by comparing the costs of a simple, but good amplifier with those of a high-grade and more powerful job. Whether this cost is justified is purely a matter of how much you wish to pay for it.

I would say that the extra money might be better spent in obtaining a high quality speaker, if you cannot have both.

RADIO TUNERS

A point worth considering, too, is that many amplifier enthusiasts use their equipment in conjunction with a radio tuner for broadcast listening. The advantages of good equipment for receiving studio concert broadcasts are often more marked than for recordings, for we have no needle scratch to impose an upper limit. As Mr. Williams points out elsewhere, a really good speaker might require some top-end cutting for records, but can be used on such broadcasts "wide open." The two go hand in hand of course, because although a good speaker will improve results from a good amplifier, it will do an even better job with a very good one.

In my own case, I have two amplifiers—one a straight job, and the other based on the Williamson circuit with numerous additions. The latter, I think, sounds better, but mainly because I took more care with it. Its bass end is better, not only because of its circuit but because the output transformer is well-nigh perfect, whereas the other's is just a very good one, and my speaker system is good enough to pick the difference. But they are both of such an order that I can be quite happy listening to either one.

QUALITY SEARCH

And after all, that is about as near as we can come to resolving the matter. We will always try to build better amplifiers, and to find better speakers and pick-ups, because, in the long run, it is the total result which matters, and it is the chain of improvements which is most important.

As all our components, and I hope recordings, improve with time, undoubtedly the man with the best amplifier will begin to win out, even though many of his advantages are subtle rather than sweepingly evident. One of the fascinations of amplifiers is the urge to make use of the best designs in the long road to possible perfection. If this is also your approach, then there is no hope for you. You will rebuild your amplifier no matter what I might say!

"WASTE" coffee, about one-third of the world's production that is unsuited for beverage and was dormerly dumped or burned, is being made into soap products. The soaps remove dirt, grease, stains, ink and paint. A new process separates the natural oils from roasted coffee beans after they are ground. The oils are treated with alkali to produce soap. The caffeine extracted is used for medicinal purposes. Odorless, "coffee soap" eliminates foreign smells and has proved nonallergic in hospital tests.

PHONOMOTORS

Keen buying enables us to offer these high quality English motors at this rock bottom price.
Features are: silent—high power—constant speed — self-lubricating bearings —plays 10" to 12" records.

45/- ea.

Postage and Packing Extra.

WILSON'S MUSIC STORE
HAY STREET, SYDNEY.
Opp. Capitol Theatre. MA3208

You wouldn't use a PLOUGH on your Records!

YET that is what you do when you use ordinary steel gramophone needles. Like jagged saw-teeth, visible only under a microscope, ordinary gramophone needles destroy the modulated groove and quickly ruin your records.

Change now to micro-polished A.R.C. "Greenshank" Radiogram needles—as used by leading radio stations. Hundred 6/6

Microphotographs reveal amazing differences

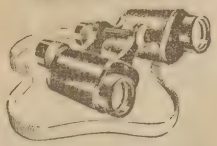
Two unretouched photographs showing needle tips enlarged 50 times.

Ordinary needle — Imagine what a needle like this will do to your records.

A.R.C. needle — Tip is micro-polished to ideal dimensions.

A·R·C
"Greenshank" Shadowgraphed
STEEL NEEDLES
FROM RADIO AND MUSIC STORES
Australian Record Co. Pty. Ltd.,
29 Bligh St., Sydney. BW3339.

Imported Prismatic Binoculars



We have a grand assortment of Binoculars, including some of the best German, English and French makes.

LARGE RANGE AVAILABLE

6 x 24 .. £10 10 0 Wide Angle £12 10 0
6 x 30 .. 12 10 0 Wide Angle 14 10 0
8 x 24 .. 13 10 0 Wide Angle 15 10 0
8 x 30 .. 15 0 0 Wide Angle 17 10 0
Wide Angle 7 x 50 .. £25 0 0.

JUST ARRIVED — BRAND NEW.

Imported Prismatic Binoculars, 8 x 25, Wide Angle. Complete with case. £17/10/- value.

Special Price, pair **£12/10/-**
Well packed. Post Ins. Free.

Super Tool Offer

BEST QUALITY SPANNERS

1 Steel ¼ x 5/16 Whit. Spanner, 1 Ring and open end Spanner, 7/16 SAE, 1 Ring and open end spanner, ½" SAE, 1 Ring and open end Spanner, 9/16 SAE, 1 15/16 x ¾ SAE Spanner, 1 13/16 x ¾ SAE Spanner, 1 Ball Pein Hammer, 1½lb.

The Lot £1/10/-
Post: N.S.W., 2/-; Interstate, 3/6.

Gas Bottles

As used to inflate rubber dinghies. Will hold many pounds of pressure. Approx. 12 inches long 3 inches in diam. weight 3½lb Sturdily constructed with screw top release valve.

Only .. .. **10/- ea.**
Post: N.S.W., 1/6; Interstate 2/6

AMPLIFIERS

EX-AIR FORCE

Amplifiers Type A1134, Ref. No. 10D/11500. Serial No. 5730, Complete with valves.

EACH **39/6**
Post N.S.W., 2/-; Interstate, 3/6.

Pocket Watches

ELGIN Army Pocket Watches. Elgin 7 jewels. Guaranteed in perfect condition. Luminous figures, black dial. Regular 7 guinea Value.

PRICE,

65/- ea.

Post FREE.

Extra Special Wet Weather Offer

Brand new RAINCOAT, Army anti-gas; 1 brand new sou'wester.

The Lot for 8/6
Postage: N.S.W. 1/6; Interstate 2/6

Army First Aid Outfits

First Aid Outfits made for the Army by Johnson and Johnson.

Contents: 1 Acid Tannic Jelly, ¾oz tube; 1 Pencil Antiseptic (Profiavine); 1 First Field Dressing; 1 Triangular Bandage; 1 Plaster Adhesive ½" x 1yd.; 2 Bandages W.O.W. 2" x 2yd; 2 Bandages W.O.W 3" x 4yd.; 3 Safety Pins, 1½". Complete in special Compact Size Tin.

Each **3/6**
Postage: N.S.W., 9d; Interstate, 1/-.

SPECIAL PURCHASE

Jungle Green Shirts

BRAND NEW, EX-ARMY.

No need to tell you about the quality of these shirts, as you already know, but take our advice and purchase now while they are still available in sizes 15½ to 17½ inch neck only. 27/6 value.

Price, each **12/6**
Post: N.S.W., 9d; Interstate, 1/3.

Khaki Lumber JACKETS

Khaki Lumber Jackets. Genuine Airtex Drill. Brand new ex-Army Hard wearing, yet look smart. Youths' and Small Men's sizes. Cost the Army 19/6 each.

Our PRICE, ea. **7/11**
OR 3 FOR 22/6.
Postage: N.S.W., 1/-; Interstate, 1/6.

SANDBOOTS

These are brand new American pattern. Thick, spongy soles, reinforced toe cap and ankles in two-tone effect. Three different colours: Blue, White and Brown. Ideal for gymnastics and general sports. Sizes 8 to 10. 25/- value.

Our Price, pair **13/8**
Postage: N.S.W., 1/-; Interstate, 1/6.

Machine Gun Reflector Gunsights

Ex-Air Force. Containing best quality lenses. Approx. 1¼ inch diam. 19/6 each. Postage, 2/- extra.

REFLECTOR GUNSIGHTS

Ex-Air Force. Containing best quality condenser lenses and adjustable reflector. Parts can be used for many purposes.

39/6 ea:
Postage 2/6 extra.

COMPONENTS INCLUDE THESE VALUABLE LENSES.

1 2 3 4 5 6

No. 1 Diam. 3⅜ Foc. Len. 10in. No. 2 Diam. 3¼ Hollow Ground. No. 3 Diam 3¼ Foc Length, 4½in. plus No. 4 Diam 2⅜ Foc. Length 6½in. plus No. 5 Diam. 1⅛ No. 6 Diam. 1-18 Amber Coloured ordinary.

Black Oilskin SOU'WESTERS

Ex-Navy. Brand New. Original price 8/6. These are super quality. Out they go.

EACH **3/6**
Post: 6d N.S.W.; Intrstate, 9d.

OIL PAINT

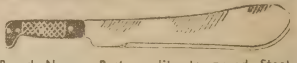
A Genuine Oil Base Paint extra good quality. Grey, Red, Cream, White, Chocolate, Light Stone, Dark Stone, Mid Stone, Green.

1 Gallon Tin **£1/7/6**

4 Gallon Drum **£5/-/-**

Please add 1/- Cartage to Rail. Freight payable your nearest Attended Railway Station

Machete Bush Knife



Brand New. Best quality tempered Steel, approx. 15 inches long. Ideal for scrub cutting, butchering and general utility. knife. PRICE **6/6**
Sheath 1/- extra. Post 1/- extra.

KHAKI SHORTS

BRAND NEW

A smart, hard-wearing short, with overlap belt and adjustable sidestraps. Sizes 30" to 38" waist.

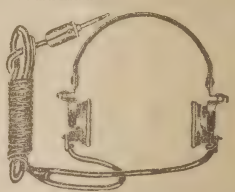
Pair **13/3**
Post: N.S.W., 9d; Interstate, 1/-.

Carpenters' Claw Hammers

Ex-Army. Brand New. 24oz.

4/6 & 5/11 each

Postage, N.S.W., 1/3; Interstate, 2/-.



HEAD PHONES

Brand new S.T.C., complete with cord and plug.
2000 ohms impedance **£1**
Suitable for crystal sets. Postage 1/6 extra.

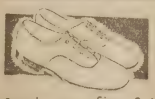
Army Packs

Genuine webb full size Army packs. Ideal for hiking, work, camping, etc. Cost the Army 19/6 each. Our price

5/6 & 6/11

We have also a quantity of Brand New Genuine Canadian Webb Packs. First time in Australia. These cost the Army 35/- each

Our Price, each **12/6**
Postage: 1/- N.S.W.; Interstate, 1/6.



SHOES

Best Quality White Canvas Shoes, made in England, leather soles. Ex-Royal Navy.

Brand new. Sizes 8 to 9 only. Worth 42/- pair.
OUR PRICE **12/6**
Postage: N.S.W. 1/9; Interstate 2/6.

* - SORRY, NO C.O.D.

DEITCH BROS.

DEPT. R., 70 OXFORD STREET, SYDNEY.

ANSWERS TO CORRESPONDENTS

C.W.A. (Gilbert & Ellice Is.), forwards his subscription and makes some comments on radio conditions at his location. He also mentions that he hopes to have an amateur station, under the call sign of VR1A, apparently on the 14 and 28 mc/s bands in the near future.

A. Many thanks for your subscription which has been duly noted by the appropriate department. We were very interested to read your comments and to note that you find the 14 and 28 mc/s bands of most value at your location. Possibly the better reception of American stations you observe is partly due to their number and the high power they frequently use. We wish you the best of luck with your amateur station and hope that before very long to have the pleasure of talking to you on the air.

H.F.F. (Bundaberg, Qld.), writes to thank us for information supplied through the 1/- query service.

A. We are very pleased to note that we have been of assistance to you. We can appreciate the difficulty you have in obtaining components at your location due to delays in answering correspondence &c.

J.E.J. (Eltham, Vic.), wishes to use a 2500 ohm speaker transformer with the single valve 6V6-G amplifier described in the February, 1949, issue. He quotes the descriptive article as saying: "In this connection, if you happen to have a 2500 ohms speaker you wish to use, you may do so if the speaker is of the 385v type." He also wishes to know if a 25 cycle supply is suitable for operating the filaments of 6.3 volt valves.

A. By a 2500 ohms speaker, we meant a speaker with a 2500 ohm field coil. With a 385 volt transformer, the excess power is used in exciting the field coil of the speaker. The amplifier as originally described used a permanent magnet speaker therefore provision for field excitation was not required. The load resistance for the 6V6-G is a different matter. For best results the recommended load resistance is 5000 ohms. You could use a 2500 ohm transformer if you already have one on hand and do not wish to buy the correct transformer at the moment. The main effect will be a slight falling off in the power output. You could use 2 6V6-G's in parallel to obtain the correct condition for your transformer. But in overcoming the problem of the mismatch you introduce another problem, namely, that of supplying current for the extra valve. The 6.3 volt valves should work with a 25 cycle supply without any detrimental effects. You may need more filter capacitance or a larger type filter choke.

Many thanks for your kind wishes.

P.J. (Coonamble, NSW), is interested in super modulation, also the "All Wave de Luxe" receiver.

A. We are not sure whether this receiver is available in kit form—all done up in a cardboard box and tied with string. However, you should have no special difficulty in purchasing all the parts and we suggest you place an order with one or other of the distributors who advertise in this magazine. We have never tested it side by side with the receivers you mention, but expect that it would have a somewhat better performance. The band spread feature is, of course, invaluable for the amateur. The plate and screen current in a super modulated stage increases considerably during the modulation and you would not be far out in suggesting that the current doubles. In practice, of course, the additional current flows in surges, according to the modulation and the effect on a current meter is simply to make it swing rather wildly. For speech work, it would probably be adequate to leave a margin of 50% on the current rating of power equipment to cover the additional drain. Large filter condensers can supply most of the peaks satisfactorily, and it is therefore not necessary to take any special precautions in regard to the regulation.

J. G. O'L. (Tusmore, Adelaide), sends in a circuit for review in the Junior experimenter section and also a question for Here's Your Answer Tom.

We were pleased to hear of your success with the small sets J. G. O'L. We will review your circuit and answer your question as soon as possible.

E.S. (Moorabbin), sends in a report about a radio club which has been formed in the district.

A. Your letter has been forwarded to Bill Moore who handles our amateur notes. We do not make a policy of carrying club notes, as separate items, although Bill Moore may see fit to make mention of your activities in his page.

YOUR QUERY?

1. Queries will be answered in rotation through the columns of our magazine if not accompanied by a fee for a postal reply.
2. Queries, neatly and concisely set out, will be answered by mail as quickly as possible if accompanied by 1/- in postal notes or postage stamps. Endorse envelope "Query."
3. Back numbers are rarely available but reprints of most circuits, wiring diagrams, and parts lists will be supplied for 6d each, minimum charge 1/-. Thus a circuit, layout, and parts list will cost 1/6 in stamps or a postal note. Endorse envelope "Circuit."
4. Blueprints of exact size chassis layouts with all essential holes and cutouts will be supplied, if available, for 2/6. Endorse envelope "Blueprint."

Address your letters to the Technical Editor, Radio & Hobbies, Box 2728C, GPO, Sydney.

SPECIAL NOTE:—

In an admirable thirst for knowledge, some of our readers have been submitting letters which read more like a technical quiz session than legitimate queries! We do want to help you, but there is a definite limit of time which can be set aside for answers. Some conscience-stricken readers have enclosed up to 5/- with their letters, but much as we appreciate the thought, the fact is that if we spend all our time answering involved questions, we will have no time left for the magazine.

Help us, therefore, by restricting your queries to troubles you are having in your contructional work, by asking not more than two or three at a time, and by avoiding general theoretical questions which it is not the function of the Query Service to answer.

—THE EDITOR

L.G. (Snug, Tas.), forwards a circuit for comment in the "Junior Experimenter" section.

A. Many thanks for your interest, L.G., and your circuit will be dealt with at the first opportunity.

A.N. (Maroubra, NSW), forwards a circuit diagram for comment through the columns of the Junior Experimenter in reply to a suggestion made in those columns in the November, 1949, issue of R & H.

A. Thanks for your contribution, A.N. We are preparing your diagram together with the appropriate comments on design and hope that this information will appear in an early issue.

C.R. (Sans Souci, NSW), has enquired as to the practicability of using miniature components in the circuit of the Universal Five, published in the January, 1949, issue of R & H with a view to housing the completed set in a small-size mantel cabinet.

A. We doubt whether you would be able to fit the set into the size of cabinet which you have in mind even though you intend using miniature coils and IF transformers. You would need to use miniature 6.3 volt valves together with a smaller power transformer. The size of transformer as was used in the Corner Set of the December, 1949, issue would probably be suitable. However, apart from the foregoing, the amount of audio power available from the 6V6-GT type of output valve is much in excess of that necessary to operate the size of speaker which you fit into the small cabinet in question. At the most, a 5-inch speaker would be all that you could fit in. Under the circumstances, you could obtain as much usable performance from a 3 valve set along the lines of the Little General or the Corner Set. The point which you raised regarding stability would not be effected by the use of the miniature components. In this respect, the importance lies with the general layout of the set and the associated wiring provided that the basic design was in order.

A.L.C. (of Thornleigh, NSW), sends in a query for the "Answer Tom" page.

A. Thanks for your letter and it will be dealt with at the first opportunity.

P.V. (Maroubra, NSW), sends in two suggestions for comment. The first consists of a pickup on which is mounted another pole. This is arranged in such a way that any vertical movement in the armature will induce a voltage in a second coil wound on the additional pole piece. He reasons that as the vertical output will be all scratch it should be possible to cancel some of the surface noise by applying the output from the second coil to a suitable negative feedback circuit. The second idea is that records should be made by recording a supersonic carrier on which the audio is impressed.

Unfortunately, P.V., your ideas are basically unsound and any attempt to make them work would be doomed to failure.

Firstly vertical movement of the stylus in a lateral pickup produces little or no surface noise in the output, the surface noise which is present is a result of lateral movement caused by the roughness of the groove wall. It would therefore be useless to expect any possible noise voltage produced from vertical movement to have any cancellation effects on that produced by lateral motion of the stylus. The second idea is basically unsound because at the moment it is mechanically impracticable to record and reproduce frequencies sufficiently high to be used as carriers. Secondly the modulation would produce sidebands extending 15kc odd either way so that it would not in any sense be a "single frequency" system.

G.E.N. (Glenorchy, Tas.), comments on our statement that recording wire is hard to obtain in Australia. He says that, for the cost of 5/-, he obtained a price list and instructions from a firm, Park Radio, of Manor Park, 676-8 Romford Road, London, E12, England. "They have Crown High Fidelity recording wire £2/8/6 for 3800 feet, enough for half an hour's recording. They also have "Diamond" Recording Tape, £2/17/6 for 1200 feet, also enough for half an hour.

A. Many thanks for the letter, G.E.N., and the information has been printed above for any other reader who may care to follow it up. We presume that the prices mentioned are in sterling, so that exchange would need to be added.

R.S.W. (Petersham, NSW), is interested in obtaining some information on the construction of small rockets.

A. We regret that this matter is beyond the normal scope of our magazine and we have no information on the subject.

AIRCRAFT
U.S. and U.K. Air Forces.
CLOCKS
BRAND NEW.

These clocks are ideal for car, caravan, home, motor bike, aircraft, boat, dark room or any place where a reliable, accurate timepiece is required.

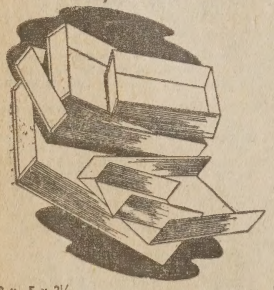
All Clocks listed have jewel lever movements.

AMERICAN
(Similar to illustration.)
8 DAY, LUMINOUS DIAL, with sweep-centre second hand.
BULOVA £5 7 6
ELGIN £5 5 0

ENGLISH SMITH'S
(Attractive round design, with dummy time of flight hands.)
Luminous, 8 day, with sweep-second hand £5 2 6
Luminous, 8 day £4 15 0
Non-Luminous, 8 day £4 12 0
ENGLISH 1-DAY, luminous dial, with sweep-centre second hand and dummy time of flight hands. **£2/17/6**
NEW .. ..
(All Registered Post Free.)

M. GOODMAN
422 PITT STREET, SYDNEY, N.S.W.
All orders promptly attended to. Please send Cheque, Money Order, or Postal Notes. Sorry, No C.O.D.

ALUMINIUM CHASSIS
Easy to Work



8 x 5 x 2½	.. ..	5/-
10 x 6 x 2¼	.. ..	6/6
13 x 7 x 2½	Welded	7/6
13 x 10 x 2½	Ends	9/-
17 x 8 x 3	.. ..	14/-
17 x 10 x 3	.. ..	15/-
6 x 4 x 2	Open	3/6
12 x 7 x 2½	Ends	6/6

POWER RESISTORS
Only sizes available. Stocks limited.
30 ohm 120 watt,
174 ,, 85 ,,
10K ,, 20 ,,
3/- ea.
While they last.

COLLINS RADIO
409 LONSDALE ST.
MELBOURNE, C.1.
for Fast Mail Orders.

Answer to Correspondents

J.L.M. and E.B. (Woodville Gardens, SA) ask our advice about building a de luxe radiogram.

A.: We would suggest the "1947 Senior Radiogram," which was described in the June issue of that year. The set uses eight valves and has an audio power output in excess of 20 watts. The record changer is a separate item and a matter for your individual taste. A circuit, wiring diagram and parts list for the "Senior Radiogram" is available through the query service for 1/6.

K.B. (Irrewillipe East, Colac, Victoria) asks if we can supply him with the necessary information to convert a 2-volt portable set for operation in a car fitted with a 6-volt electrical system.

A.: It is not impossible to convert the set as you suggest, K.B., but there are many problems. The most important of these is the elimination of ignition noise when the set is connected to the electrical system of the car. The filtering of the low-tension circuit to the valve filaments would have to be extremely good to stop hum originating from the vibrator and generator. There is also the problem of vibrator hash. Unfortunately, K.B., we have no suitable circuit on hand, and, much as we would like to help, we just have not time to design special circuits for readers.

J.R. (Maryborough, Qld.) asks us to supply him with "details for the construction of a cross-bow or spring gun suitable for shooting a steel arrow, or a type of spear, at fish."

A.: We are afraid that your query is a little beyond the scope of our paper. We realise that many people are interested in these things but the line must be drawn somewhere.

R.A.C. (Caulfield, Vic.) would like to obtain the circuit of a four-valve mains operated receiver.

A.: Several receivers answering your description have been described in past issues of Radio and Hobbies. The circuits may be obtained through the shilling query service. In some cases wiring diagrams and/or underneath photographs are also available. We suggest you write to us through the shilling query service and give further details of the type of receiver you require. The "Little General" receiver is very popular and has been giving good results for thousands of constructors over a number of years. The 4-48 is a superhet. along the same lines but using more modern components and allowing more compact construction. For an inexpensive receiver for local listening with good quality, we would recommend the "Metro Four."

J. Van Z. (Cecil Plains, Qld.) asks how to connect headphones to the "All Battery Five," and, in addition, asks a couple of other questions.

A.: Phones would work if wired to the speaker terminals without any additions or alterations to the circuit. However, there are at least two reasons why this is undesirable. The steady current through the bobbins is likely to affect the magnets and there is the possibility of shock. Although the 90 volts high tension is not actually dangerous, it can be unpleasant. A good idea is to use the primary winding of the speaker transformer as a choke. The secondary winding and voice coil circuit is broken. One phone terminal is connected to earth and the other to the plate of the 3V4 through a .25 mfd. condenser. Usually the tone control in battery receivers is limited to the top cut type. This is because the capabilities of battery receivers are limited in any case by the relatively low power output. The "All Battery Five" includes a conventional "top cut" tone control consisting of potentiometer R12 and condenser C20. Actually 2-volt battery receivers were quite common a few years ago. However, it was found that 2-volt vibrators are not as reliable as their 6-volt counterparts and most vibrator receivers are designed for 6 volts nowadays.

INTRODUCING
A LITTLE TRIMMER!
Actual Size

Jabel
JUNIOR

- Clear Polystyrene for factual High Q.
- Unique Plate Design and fine thread for smooth adjustment over capacity range of 4 to 40 mmfd.
- Tapered plates in tapered slots for maximum stability.

ONCE TRIED ALWAYS SPECIFIED

Jabel Products
FACTORY REP.: WATKIN WYNNE, NTH. SYDNEY

INSTRUMENT CASES
We specialise in All Classes of Covered Cabinets—Instrument, Portable and Mantel Radio Cabinets in either Leather or Leatherette.
GIBBONS & DENHAM
122 DARLING St., BALMAIN
Phone : WB2772, Sydney.
For Trade only.

. . . for all Meter and instrument Repairs call on the
METER REPAIR SPECIALISTS
FOR PROMPT EFFICIENT SERVICE
ZENITH RADIO CO. Pty. Ltd.
131-133 Palmer St., (Off William St.) Sydney.

PLAY THE PIANO
Learn in 50 days!

Amaze your friends and family—be the life of every party! Play the latest hit tunes, jive, boogie—by ear. If you can whistle, sing or hum a tune, you can easily and quickly learn this new, simple - as - ABC method. Complete instruction course, 10/-, post free. *Send to-day and learn to play!*
ALPHA POWER CO.
30x 3856V, G.P.O., Sydney.

A SPECIAL RECEIVER FOR 32 VOLTS

(Continued from Page 35)

The wires from the detector to the volume control and back to the audio stage should be run with shielded lead.

Connection to the speaker is made through a socket mounted on the rear of the chassis and a corresponding plug on the speaker lead.

As a precaution against instability, and also interference from the line being injected into the receiver, we have installed a decoupling network, consisting of a choke and 16 mfd condenser, between the 32-volt line and output stage, and the earlier stages of the set.

There is no need to decouple the output stage since, being push-pull, it will not respond readily to interference on the supply line. The .1 and 16mfd condensers, shown as optional on the circuit, are not required in most cases, but may help in solving stubborn cases of generator interference.

By the way, as a protection to both the receiver and the mains wiring in case of shorts and/or reversed mains polarity, we have included a 5 amp. fuse in each incoming mains lead.

It is not standard practice to take the elaborate precautions with earthing and insulation, necessary with a high voltage system, with a 32-volt system, because there is little danger of shock. In fact, the leads from the generator are often brought out to two insulated terminals and the whole system is not earthed in any way. The chances are that if a radio is connected to such a system while the generator is charging, some interference will be experienced

We have known cases where this interference has been tolerated or the radio is simply switched off while charging is in progress.

However, since eliminating the interference is usually quite simple, most of our readers will not want to put up with it.

First of all, make sure that the frame of the generator is effectively earthed. Heavy copper braid is suitable, and the lead should be as short as possible. A length of water pipe driven into the ground makes an effective earth.

At the same time, earth the negative terminal of the generator. Generators are usually shielded so that the earthing and perhaps a .25 mfd condenser connected from the positive terminal to earth will normally be all that is required.

FILTERING

In more difficult cases, it may be necessary to add extra filtering. This can consist of a low resistance choke and another condenser. It is particularly important that the choke have low resistance, otherwise power will be wasted.

We have not had the opportunity to conduct any experiments with suitable chokes, but we would imagine that a choke consisting of about 25 turns of 14-gauge wire wound with a diameter of about ⅜in, would be suitable. The second bypass condenser may also have a capacity of .25 mfd. Some experiment may be necessary to determine the exact position where the condensers are most effective, however, it is certain to be very close to the generator.

Before taking any elaborate precautions to cure interference, make sure the commutator of the generator is clean and running evenly. Also make sure that the brushes are properly bedded in and adjusted to the correct tension.

In cases of ignition interference from the driving motor, a motor car suppressor resistor will probably prove effective. If the motor is not automatically earthed by being connected to the generator frame, it may be desirable to make special provision for earthing.

We do not anticipate that you will encounter all the problems we have mentioned, but we bring them up in case of individual difficulties.

If you have the experience of building one or two small sets behind you, there is no reason why you should not be able to build this receiver, and get it operating smoothly. It is just the thing to provide entertainment for the long winter evenings and there is plenty of time to order the parts and get the set going before then.

Do you need a SPECIAL or STANDARD

TRANSFORMER

URGENTLY?

We will be pleased to supply you at short notice with just what you need so that you may get on with your job.

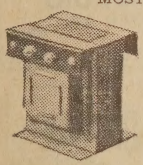
WE MANUFACTURE ALL TYPES OF

Power, Output, Modulation, Interstage Transformers, Variable Transformers, Instrument Transformers.

CURRENT TRANSFORMERS TO EXTEND THE RANGE OF ANY INSTRUMENT TO READ AC AMPERES.

HI-FI EQUIPMENT AND TRANSFORMERS TO SATISFY THE MOST CRITICAL ——— AND AT THE RIGHT PRICE, TOO

NOVA



GRAMOPHONE MOTORS

High-powered silent synchronous motors, 78 R.P.M. Available immediately ex-factory.

'NOVA'

ELECTRICAL AND ENGINEERING CO.,
311 SUSSEX STREET, SYDNEY. MA1786.

Write for your FREE copy NOW!

DUCON Noise Suppression BULLETIN

The suppression of radio interference is very much to the fore in these days of high fidelity sets. Anyone who has struggled to obtain satisfactory reception through the appalling noise which can exist in bad localities, will welcome the attempts which are being made to combat such disturbance.

Ducon offers this booklet in the hope that, by so doing, radio users and those interested in the successful merchandising of Radio will find something of interest, and, perhaps assist in the efforts being made to reduce interference. In many cases the interference can be remedied at the source, and it is mainly with this phase of the problem that the Ducon Company can be of service.

DUCON Capacitors

DUCON CONDENSER LTD.,
73/91 Bourke St., Waterloo. MX1441.
Please forward me without obligation my FREE copy of "Ducon Noise Suppression Bulletin."

NAME .....

ADDRESS .....

.....

Wanted to Buy, Sell or Exchange

FOR SALE: 2 converted receivers, 11 valve BC348Q, 6 valve BC454, 6-9 mc's. Valves 2 new 35T's, 1 Gammatron 25T. **W. Wells, 23 Waterloo Street, Camberwell, Melbourne. Phone WF7132.**

FOR SALE: Type 3 Mk 2, manual, all spares, perfect order. What offers? **Boase, 7 Park Avenue, Glenhuntly, Vic. Cent. 1746.**

FOR SALE: Collaro Auto Stop Turntable, as new. **G. J. Wood, 5 Bruce St., Toorak, S.E.2, Vic. Phone BJ3496.**

SALE: New Camera, Ensign Commando, £3.5 lens, everready case and all accessories, £45. Write **D. Adams, 81 Beaumont Street, Hamilton, N.S.W.**

SALE: Most issues "Radio & Hobbies," Jan., 1946, to present; also "Popular Photography," best offer. **Schofield P.O., Gundagai.**

SELL: Stromberg Carlson record changer, almost new, £11, or best offer. **H. Batten, 20 Victoria Grove, Auburn, E.3, Melbourne.**

SELL: Radiola 267V Console, 7 valve vib. recr., 3 bands, 12" spkr., per. order, offer. **J. W. McKean, 74 St. Hellier Street, Heidelberg, Vic. JL1773.**

SELL: Bound volumes of R & H, offers. **D. Dennis, Coolangatta, Q'land.**

SELL: 67 copies R and H, 44 R. World; 1940-8; inquiries invited. "Modern Radio Servicing" — Ghirardi, "Service" Slide Rule. **J. Stubbs, 27 Rowley Road, Five Dock, N.S.W.**

SELL: Transceiver, 80-40, complete, modulator, crystal, A.C.-D.C. A.M.K. III, £18, or offer. **26 Collins St., Belmore.**

SELL: All Radio & Hobbies except six. Reasonable offer to **R. Sharp, 27 Oswell Street, Rockdale, N.S.W.**

SELL: Rola-G12S, new cones, fields (1000, 2500, 3500) less transformers, £5 each. Gramo Motors, 12v AC/DC, O.K. electrically, slight mech. faults, £1 each. Write **A. W. Fuss, 49 Balmain Road, Leichhardt, N.S.W.**

SELL: New "Minivox," maximum performance, £7, or near offer. Must sell. **B. Proudlock, 72 Edward St., Bondi, N.S.W.**

SELL: Steam charging set, 6/8 volt, 4 amp. English make, used once, £25. **W. White, Katomatite Rd., Cobram, Vic.**

Readers wishing to buy, sell or exchange goods are invited to insert an advertisement on this page. The cost is 1/6 per line; approximately 5 words to a line. Advertisements for the next issue must reach our office by WEDNESDAY, NOON, January 11, 1950. Dealers' Advertisements not accepted.

SELL: Bendix RA-1B. Rec. as new, 8v. 150kc-15 megs. cont. coverage. Superb set. With separate speaker and power unit, £37. **Walsh, FM1553, Sydney.**

SELL: 3 stage D.W. Unit, complete with gang, valves (6SK7, X61M), R.C.S. intermediates, FDCD/32 D.W. Dial brand, new and assembled, £8. Marmac H.D. Gramo-motor and Tecnico sapph. hi-fi P.U., as new, £8. **D. Adams, 81 Beaumont Street, Hamilton, N.S.W.**

SELL: Complete parts for Universal-Five, except speaker; also 6X5-GT, 6SJ7-GT valves in good condition, 40 issues R. & H. from July, 1946, onwards, £10 lot. **Schade, 210 Wattle St., Bendigo, Victoria.**

WANTED: Plugs and cables for connecting Bendix RA, 10 F.A. receiver to remote control unit. **K. Semmler, Box 26, Murtoa, Victoria.**

EXCHANGE: Triplett Signal Generator, as new, frequency cov. 100 Kc to 120 M.C. Crystal calibrated. Internal or external modulation, output attenuator and metering system, with special output switching for R.F. or I.F. connection, exchange for recording outfit or offer. Write **171 Arthurton Rd., Northcote, N.16, Vic.**

Radio Despatch Service

New Year Specials

Universal jet age jugs, grillers—standard jugs—irons—toasters—bed lamps. Complete range of all radio valves and parts. Portable gramophone units with inbuilt amplifier—Range of radio sets.

Phone MA1876 or call Wembley Hse, 841 George St., Railway Square, Sydney.

OPPORTUNITY FOR 1950

Send for details of a Special Postal Course in PLASTICS. Learn to make beautiful plastic articles right on your own kitchen table. This is Your chance for a Business of your own. DON'T MISS IT. Write TO-DAY. **Dept. B, Le Bon College (regd.), Box 279, Haymarket P.O., Sydney.**

ROYCE RECORDING DISC SPEAKS FOR ITSELF

Special Line of Blanks:—

6"	1/9	8"	3/9
7"	2/6	10"	5/-

Write for Price List of Recording Accessories

MANUFACTURED BY

"PLAYBACK"

BOX 5041Y, G.P.O., MELB., VIC.

SONGSTER REG'D PICK-UP & PHONO NEEDLES

SIX FEET

TALL AND EVERY INCH A MAN OF MUSCLE

Increase your height by inches — grow a towering, husky body with muscles of steel. Look over the heads of crowds—have them look up to you. Be powerful, strong, admired. Complete illustrated Height and Muscle Building Course. Price, 13/6 postal note.

ALPHA POWER CO.

Box 3856V, G.P.O., Sydney.

VALVES

SPECIAL PURCHASE

6A8G		EL3NG
6U7G	10/-	EL3NP
6J8G		6H6GT
6B8G		EBF2P
6B6G	EACH	EL2P
6F6G	ADD	50L6GT
6A7G	POSTAGE	6K7GT
6D6G	1/-	1K7G
6J7G		1L5G
6X5GT		1C7G

GUARANTEED NEW AND TESTED

RIVEN RADIO

354 CHURCH ST., PARRAMATTA. UW6731.

AERIALS ELIMINATED

The CAPTAIN AERIAL UNIT equals a 50ft. high aerial, gives tone, volume, sensitivity, more stations, freedom from lightning. Reduces static, fits inside your set. Does away with poles and guy wires. Broadcast or short-wave reception. Installed in a minute—nothing to get out of order. **PRICE ONLY 5/9.**

POST FREE—NO. C.O.D.

Money Refunded If Not Satisfied.

REG COOKE

P.O. Box 9 (H), Gerringong, N.S.W.

CRYSTALS FOR SALE

100 and 1000 Kc/s Genuine G. E. Vacuum Mounted 0.01% Accuracy suitable Bendix Frequency Meters and other Precision instruments. £5/5/- each plus sales tax (8/9) posted

R. H. Cunningham & Co.

62 Stanhope St., Malvern Vic. UY6274.

MODELS: Locomotive Castings and Designs all gauges. Latest Engineering Catalogue 1/6. O. B. Bolton, **Room 1**, 70 King St., Sydney.

MoToR BOATING'S IDEAL SERIES

Published in separate volumes. Covering a Range of over 15 Volumes. You can purchase any single Volume on HOW TO BUILD SAIL BOATS, MOTOR BOATS, OUTBOARD MOTORS, Etc. Write us for full list of volumes or for the Style of Boat you wish to build. Each Volume contains Blue Prints AND/OR Drawings with instructions on how to Build the Particular Boat you are interested in.

Representatives for Australasia and N.Z.:

ASSOCIATED TRADE JOURNALS COMPANY,

Frazer House, 42 Bridge Street, SYDNEY, N.S.W.

Printed and published by Associated Newspapers Ltd., at the registered office of the Company, 60-70 Elizabeth Street, Sydney, NSW.